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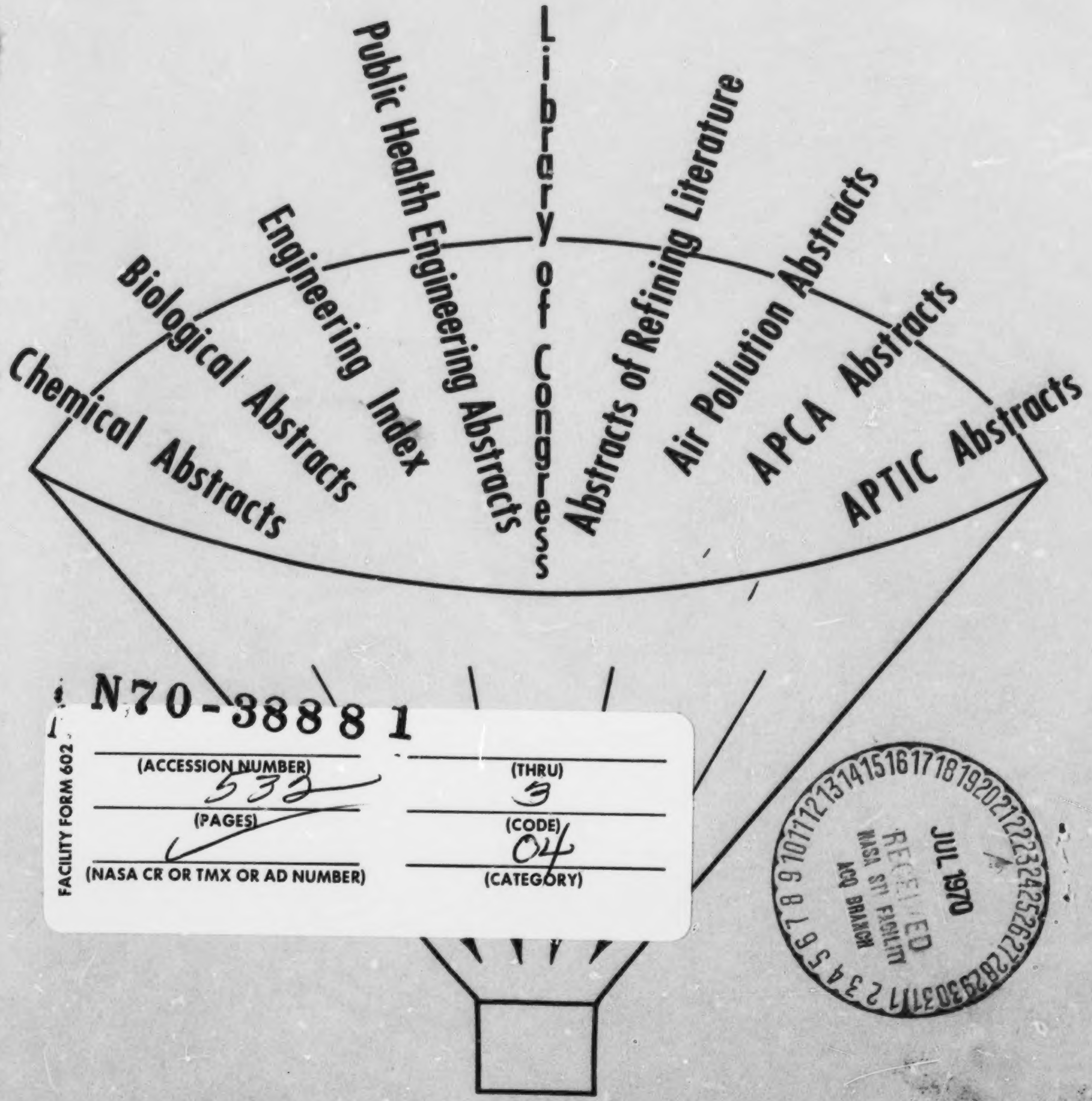

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Air Pollution Publications

A SELECTED BIBLIOGRAPHY WITH ABSTRACTS

1966-1968

U.S. DEPARTMENT OF HEALTH EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE

AIR POLLUTION PUBLICATIONS

A SELECTED BIBLIOGRAPHY
WITH
ABSTRACTS
1966 - 1968

COMPILED BY
SCIENCE AND TECHNOLOGY DIVISION
LIBRARY OF CONGRESS
FOR THE
NATIONAL AIR POLLUTION CONTROL ADMINISTRATION

U.S. DEPARTMENT OF HEALTH EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
CONSUMER PROTECTION AND ENVIRONMENTAL HEALTH SERVICE
NATIONAL AIR POLLUTION CONTROL ADMINISTRATION

PUBLIC HEALTH SERVICE PUBLICATION NO. 979
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PREFACE

This selective bibliography of air pollution publications by National Air Pollution Control Administration (NAPCA) personnel and other persons and organizations receiving Federal air pollution funds was compiled by the Special Bibliographies Section of the Science and Technology Division of the Library of Congress under a letter of agreement dated April 15, 1968. The bibliography contains over 1,000 entries spanning the literature of 1966-1968. Previous bibliographies, PHS Publication No. 979 (Revised 1964) and No. 979 (Revised 1966) cover the years 1955-1963 and 1963-1966, respectively.

Scope

The bibliography consists of references, with abstracts, to the literature originated by the staff and grantees of NAPCA on the subject of air pollution published during the period July 1966 through December 1968. (Most of the coverage for the last quarter of 1968 -- and even a few scattered references to January 1969 -- will be found in the Addendum beginning on page 477). The major portion of the material included consists of journal articles. In addition, books, monographs (handbooks, collections of papers delivered at conferences and symposia, etc.) and some report literature are also covered. While the bulk of the material is abstracted from English language publications, certain foreign items (mostly based on PHS grants awarded abroad) have also been included.

The selected references cover many aspects of the subject, including emission sources of air pollution, measurement, control, effects on man, fauna, flora, and materials, air quality standards, legal and social aspects and basic science and technology.

Arrangement

The bibliography is arranged in broad subject categories, each covering a certain area in air pollution research. Some of these categories are further subdivided into sub-categories bringing together the information on the literature of specific subject areas. Within each category, the individual items are entered alphabetically by author (and in case of no author, under the title) with a number assigned to each item. The complete bibliographic citation is followed by an informative abstract showing, in most cases, concise data as to purpose, scope, experimental methods used, results, and conclusions reached by the author.

Sources Searched

In collecting the material, a systematic search was made of several abstract sources. Abstracts not identified by a specific source have been prepared by the compilers of the bibliography.

Searches were also made of selected journals which especially bear upon the subject of air pollution. In addition, Index Medicus and Current Catalog have also been searched, completely and in part, respectively. In compiling the bibliography, the following abstracting publications were utilized: Abstracts of Refining Literature, Air Pollution Abstracts, APCA Abstracts, APTIC Abstracts, Biological Abstracts, Chemical Abstracts, Engineering Index, and Public Health Engineering Abstracts.

Indexes

Alphabetical author and subject indexes have been provided. The Table of Contents gives information on the subject arrangement of the bibliography in considerable detail. In addition, it has been attempted to provide for two to three more access points to each abstract in the Subject Index. Both in the author and in the subject index, the individual index entries are identified by the item number. The items of the Addendum, however, have not been included in the indexes.

Availability of Materials

The periodicals and books cited are available in libraries. Government-sponsored reports can be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. A limited number of Government-sponsored reports can be obtained from the Air Pollution Technical Information Center, 801 N. Randolph St., Arlington, Va. 22203.

Acknowledgements

The bibliographic team has worked under the guidance and leadership of Mr. Thomas C. Goodwin, Jr., Head of the Special Bibliographies Section, Science and Technology Division, Library of

Congress. The chief bibliographers have been Dr. Madeleine J. Wilkins, Assistant Head of the Special Bibliographies Section, Miss Jeanne D. Weber, and Mr. Norman G. Lamb. Special note of appreciation is due to Mrs. Beatrice T. Treese as well as to Mrs. Marion S. Carr, Mrs. Lillie M. Frye, Mrs. Phyllis M. Martin, and Mrs. Virginia M. Sims for their dedicated work in preparing the copy. Finally, thanks are also due to Mrs. Laverne B. Johnson and Mrs. Cleo R. Mabry, of the Science and Technology Division's Publications Unit, for their invaluable aid in preparing the volume for publication.

BIBLIOGRAPHY

I. GENERAL ASPECTS

1
AIR POLLUTION. v. I. AIR POLLUTION AND ITS EFFECTS.
Ed. by A. C. Stern. New York, Academic Press, 1968, 713p.

The chapters in this volume are: Classification and extent of air pollution problems; Gaseous pollutants in the air; Nonviable particles in the air; Viable particles in the air; Sources of radioactive pollution; Atmospheric reactions and scavenging processes; Meteorology and air pollution; Atmospheric dispersion of stack effluents; Air pollution climatology; Meteorological management of air pollution; Effect on the physical properties of the atmosphere; Effect of air pollution on vegetation; Biological effects of air pollution; Effects of air pollution on human health; Effects of air pollution on materials and the economy. (Air. Poll. Abs.)

2
AIR POLLUTION PUBLICATIONS: A SELECTED BIBLIOGRAPHY 1963-1966. Washington, D. C., Public Health Service, Division of Air Pollution, 1966, 144p. (PHS Publ. No. 979)

This book contains approximately 900 references to publications by Division of Air Pollution personnel and other persons and organizations receiving Federal air pollution funds. In addition to published papers it also includes papers presented at meetings and conferences. The entries are listed under the following subject headings: (1) Biosciences and Medicine, (2) Plants, (3) Material Deterioration, (4) Sources, (5) Measurement, (6) Control Methods and Equipment, (7) Methods and Facilities, (8) Atmospheric Phenomena, (9) Physical and Chemical Concepts, (10) Administrative and Social, and (11) Bibliographies, Reference Works and Theses. (Air Poll. Abs.)

3
Bunyard, F. L. and J. D. Williams.
INTERSTATE AIR POLLUTION STUDY OF THE ST. LOUIS AREA AIR POLLUTANT EMISSIONS RELATED TO ACTUAL LAND USE. Jour. Air Poll. Control Assoc., v. 17: 215-219, 1967.

The Interstate Air Pollution Study of the St. Louis-East St. Louis Metropolitan Area, conducted in 1963-1964, provided data for this report of air pollutant emissions related to three land-use categories: residential, institutional and commercial, and industrial. A fourth land-use category, transportation and open space, is included in some calculations. The sources of pollutants considered are: power generation, both electric utilities and industrial, fuels used for space heating, solid waste disposal, and industrial processes. The pollutant emissions considered are particulates and sulfur oxides. Cumulative frequency distributions given are based on acres of land use and corresponding emissions per unit area. These frequency distributions (actual emission conditions that can be related to known air quality levels) provide a basis for performance standards and a guide for planners and others in future city developments, not only in St. Louis but in other similar cities as well. A suggested method for determining a different type performance zoning standard is presented. This standard is based on average conditions and thus would supplement, not replace, standards based on maximum allowable emissions. Calculations for such standards relating to St. Louis are presented. (Authors' Abs.)

4
Cadle, R. D. and J. W. Powers.
SOME ASPECTS OF ATMOSPHERIC CHEMICAL REACTIONS OF ATOMIC OXYGEN. Tellus (Stockholm), v. 18: 176-186, 1966.

Some features of atmospheric atomic O chemistry that have received little attention, that need to be reevaluated in the light of recent data, that have been studied in the N. C. A. R. labs, or that encompass some combination of these 3 are discussed. Newly-calculated values for the concentration of excited atomic O below 100 km are so low that it is unlikely that its reactions contribute appreciably to the concentration of any atmospheric component in that region with the possible exception of excited molecular O. Reactions of ground state atomic O may constitute a sink for CH_4 and a source of sulfate in this atmospheric region. Many chemionization reactions probably occur in the atmosphere, and 3 possible types are considered in detail. (Chem. Abs.)

5
THE FEDERAL AIR POLLUTION PROGRAM.
Washington, D. C., Public Health Service, Division of Air Pollution, n.d., 52p. (PHS Publ. No. 1560).

A description of the Federal Air Pollution Program as it looked in the middle of 1967 is presented. Emphasis is placed on research, assistance to state and local governments, and abatement and prevention of air pollution.

6
Friberg, L. and R. Rylander.
[SWEDISH MEDICAL AIR QUALITY GUIDES] Medicinska rekommendationer rorande luftrenhetsnormer. Nordisk Hygienisk Tidskrift (Köbenhaven), v. 46: 1-32, 1966.

An attempt to develop medical air quality guides was made by a committee formed on the initiative of the National Air Conservation Committee. The national air pollution situation was discussed, a survey of the literature performed and data was discussed in regard to its validity in the prevailing air pollution situation in Sweden. Levels of SO_2 in big cities in Sweden were at times fairly close to the values where damage has occurred in other countries. Numerical guides were suggested for concentration of SO_2 and carbon monoxide. For metals, carcinogenic and mutagenic substances and pollutants causing sanitary problems the committee did not suggest numerical guides, but recommended that the concentrations of such substances should be kept as low as possible. (Biol. Abs.)

7
Goldsmith, J. R.
AIR POLLUTION MEDICAL RESEARCH [CONFERENCE]. Science, v. 154: 1588-1591, 1966.

Epidemiological studies show convincing associations between air pollution exposure and decreased respiratory function or increased respiratory symptons. Studies in this field concern the frequency of symptoms or altered laboratory tests rather than disease incidence and prevalence. Research on pollutant reaction within the respiratory system and indoor air pollution as a factor in chronic respiratory disease are discussed. (Biol. Abs.)

8
Larsen, R. I.
AIR POLLUTION FROM MOTOR VEHICLES. Ann. New York Acad. Sci., v. 136: 275-301, Aug. 26, 1966.

Motor vehicles are a major source of urban air pollution. They emit carbon monoxide, which reduces man's ability to transport oxygen to his tissues; lead, which increases man's body burden of this toxic metal; carcinogenic hydrocarbons; and reactive hydrocarbons and nitrogen oxides, which combine with sunlight to produce eye-irritating, plant-damaging, and visibility-obscuring photochemical smog, in New York as well as in California. Present and predicted air pollutant concentrations are compared with pollutant effects and air quality standards. Devices presently used to reduce emissions from new card sold in California will improve air quality, but will not completely solve the problem. Indications are that 95 percent reduction in emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from new cars sold in the United States may be needed by 1975. Such a "clean-air car" by 1975 is suggested as a research goal for automobile manufacturers. Improved fuel cells or improved battery power, at present, seem to be the most likely means for achieving this goal. Reduction of nitrogen oxide emissions from automobiles will not entirely control this pollutant, for half of the nitrogen oxides in the air come from other combustion sources. Indications are that about a 95 percent reduction in the emission of nitrogen oxides from power plants and the furnaces in offices, factories, and homes will be needed by 1975 to meet present air quality standards. At present, atomic power plants seem to be the most likely means for achieving this goal, for they could provide electrically to operate heat pumps and other devices to heat and cool offices and homes. (Air Poll. Abs.)

9
Middleton, J. T.
AIR POLLUTION — HOW 65 METROPOLITAN AREAS RANK IN SEVERITY. Nation's Cities, v. 5: 8-11, Aug. 1967.

The rankings compiled by the National Center for Air Pollution Control for the severity of pollution in the 65 U.S. Standard Metropolitan Statistical Areas are tabulated. An account is given in general terms, of the manner in which the data for these rankings were obtained. (APTIC Abs.)

10
Middleton, J. T.
THE AIR QUALITY ACT OF 1967 - A CHALLENGE TO THE SCIENTIST. Public Health Service, 1968, 9p. (Presented to the Chemical Society of Washington, Washington, D. C., Jan. 11, 1968.)

The government laboratories working jointly with the academic community and private industry under the Air Quality Act of 1967 will make possible a greatly accelerated program of research in all our areas of ignorance. Knowledge of the effects of air pollution, how pollutants move about in the atmosphere, how they are transformed, and how they are removed from the atmosphere will be expanded and refined. Better tools for measuring air pollution will be developed. Research will be conducted to allow control of those sources of pollution for which we have no controls. The effect of air pollution on health must be studied as well as its economic effect on materials. All industry and manufacturers must become aware of the air pollution problem and take steps to combat it.

11
Middleton, J. T.
A FRESH OPPORTUNITY FOR INDUSTRY. Environ. Sci. & Technol., v. 1: 206-211, Mar. 1967.

The Director of the National Center for Air Pollution Control discusses the proposed Air Quality Act of 1967 as an opportunity for the business community to carry out its responsibility for controlling air pollution. It is emphasized that until minimum national emission standards are established as provided in the act, industry is not free to make an intelligent response to the problem. Some provisions in the proposed Air Quality Act of 1967 provide that regional air quality commissions could be established that fuel additives be registered, and that federal funds could be used to construct control process demonstration plants on private property, operated by private management. Development of a process at one site on behalf of all segments of an industry is the most economical way of achieving a mutual goal. (APCA Abs.)

12
Rayher, W. and J. T. Middleton.
THE CASE FOR CLEAN AIR (SPECIAL REPORT). Mill and Factory, v. 80: 41-56, Apr. 1967.

The introduction in the form of a series of questions put to Dr. Middleton is of special interest in indicating the forward thrust of the Federal government in air pollution control since he is the Director of the National Center for Air Pollution Control which has the responsibility for the administration of the Federal air pollution control laws and regulations. His answers indicate vigorous activity by the Federal authorities where local authorities fail to act. The major provisions of the proposed Air Quality Act of 1967 are outlined as well as the existing Federal authority under the Clean Air Act of 1963. With this background of increased Federal activity and especially with the issuance of emission standards, this definitive review continues with an outline of the various types of air pollutants, their sources, and the accepted methods of control. In the section covering what is being done by industry today, examples are given of the control measures in effect at a rubber processing plant, a cement plant, steel plant, and a foundry. (APTIC Abs.)

13
Solomon, W. R.
POLLEN SYMPTOMS AND POLLEN COUNTS: THE DOCTOR'S SEASONAL DILEMMA. Univ. Mich. Med. Center Jour., v. 33: 64-67, Mar.-Apr. 1967.

This paper explains the difficulties of relating the responses of specifically sensitive persons to pollen counts such as those which appear in news media. To use locally derived pollen counts as a tool in diagnosis and in the evaluation of treatment requires an informed approach to pollen statistics and to the ecology of the patient with pollinosis. The pollen counts are the number of pollen grains found on 1 sq cm of a microscope slide previously exposed for 24 hr in a standard gravity sampler. The slide is coated with a silicone grease, petrolatum, or a glycerin-gelatin mixture and protected by a rain shield above the slide. This method has so many variables and problems in technique, data processing, and the mechanics of reporting that the significance of published counts for any given person is limited. Counts are generally obtained on unobstructed rooftops in urban situations and will not reflect localized pollen concentrations. Since it is advantageous for resort areas to be regarded as pollen free, such data should be examined most critically. Patients with pollinosis often have multiple specific allergens which, with adequate exposure, provoke symptoms. A patient with house dust and ragweed pollen sensitivity may have his worst difficulty while sweeping his home during July and August. Respiratory symptoms may be precipitated during periods of intensive fungus spore or pollen exposure by quantities of beer and wine which are tolerated at other seasons. (APCA Abs.)

14
Stern, A. C.
THE CHANGING PATTERN OF AIR POLLUTION IN THE UNITED STATES. Amer. Indus. Hyg. Assoc. Jour., v. 28: 161-165, Mar.-Apr. 1967.

In the past our principal concern has been with particulate emissions—smoke, fly ash, cinders, and dust. Nationwide, our regulatory and abatement practices reflect this early preoccupation. A growing concern are the gaseous emissions and the gaseous products resulting from atmospheric photochemical reactions. This is reflected, for example, in our present preoccupation with the automobile. Although interest in gaseous and particulate emissions will continue in the future, more attention will be paid to the particulate products resulting from atmospheric photochemical reactions. This will come from a recognition that not until the visible haze is lifted from our cities will they be truly livable. (Air Poll. Abs.)

15
Tancredi, S. A. and O. D. Nichols.
AIR POLLUTION TECHNICAL INFORMATION PROCESSING - THE MICROTHESAURUS APPROACH. Amer. Doc., v. 19: 66-70, Jan. 1968.

The purpose of this report is to describe the microthesaurus approach to indexing technical literature, as used within the Air Pollution Technical Information Center [APTIC] of the National Center for Air Pollution Control [NCAPC]. Using the Thesaurus of Air Pollution Terms as a base, a microthesaurus was constructed by dividing the field of air pollution and its effects into major categories such as Humans and Animals, Plants and Foods, Pollutants, Measurements, and others. These major categories were further divided to sub-categories such as Respiratory Diseases, Suspended Particulates, and Materials Deterioration. Finally, the subcategories were reduced to very specific terms such as asthma, bronchitis, emphysema— all subordinate to Respiratory Diseases. Approximately 1,300 terms were arranged hierarchically on three display sheets with each term coded according to the number-color scheme of a Jonkers Termatrex system. These sheets were subsequently used to deep-index several thousand air pollution documents. It was concluded that the microthesaurus approach provided the following: (1) consistency of indexing; (2) elimination of coding and spelling errors; (3) retrieval of both broad and highly specific information; and (4) adaptability to manual and mechanized systems. (Authors' Abs.)

16
Tebbens, B. D.
GASEOUS POLLUTANTS IN THE AIR. In: Air Pollution. v. I. Air Pollution and Its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 23-46.

Gas concentration and gas concentration as a time dependent function are described. Gaseous pollutants are usually of the following types: carbon-containing gases, sulfur-containing gases, nitrogen-containing gases, ozone and oxidants, or fluorine and hydrogen fluoride. The preceding gaseous pollutants are discussed with reference to their concentration and occurrence.

II. EMISSION SOURCES

17
Dickinson, J., R. L. Chass and W. J. Hamming.
AIR CONTAMINANTS. In: Air Pollution Engineering Manual, Air Pollution Control: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 11-21. (PHS Publ. No. 999-AP-40).

The parameters of an air pollution problem, particularly the problem of Los Angeles County, the measures taken to eliminate the problem, and those still needed are described briefly. The types of air contaminants, their sources, significance, and the controls in effect are discussed.

18
Kaiser, E. R.
COMPOSITION AND COMBUSTION OF REFUSE. In: Incineration Solid Wastes, MECAR (Metropol. Eng. Council Air Resources) Symposium. New York, 1967. p. 1-9.

Proximate and ultimate analyses made on regular municipal waste reveal disposal by incineration is practical. The remaining residue is excellent support for roadways and airports and requires 12 to 15 times less land volume than the initial waste. Because of the large tonnage available, the calorific values, and low SO_2 emission, refuse should be considered as a suitable fuel for power generation. (Chem. Abs.)

19
Kupchik, G. J.
ECONOMICS OF COMPOSTING MUNICIPAL REFUSE IN EUROPE AND ISRAEL, WITH SPECIAL REFERENCE TO POSSIBILITIES IN THE USA. World Health Organ. Bull., v. 34: 798-809, 1966.

The composting of municipal refuse is suggested as an alternative to the burning dumps which often cause air pollution. The various methods of composting refuse and the economics of such composting are discussed. (Author's Abs.)

20
Magno, P. J., P. E. Kauffman and B. Shleien.
PLUTONIUM IN ENVIRONMENTAL AND BIOLOGICAL MEDIA. Health Phys., v. 13: 1325-1330, 1967.

Data are presented on the concentrations of Pu in air, precipitation, total diet, milk and human tissue samples collected in the United States during the period 1964-1966. Pu^{239} in monthly composites or particulates collected from surface level air in Winchester, Massachusetts, ranged 0.047-0.437 femtocurie/$m.^3$ from May 1965 to April 1966; the average Pu^{239}-to-Sr^{90} ratio was 0.019 and the average Pu^{238}-to-Pu^{239} ratio was 0.04. Monthly deposition of Pu^{239} from precipitation over the same period ranged 0.86-8.8 picocuries/$m.^2$. Children's diets collected from six widely spaced geographical areas showed average concentrations which ranged 2.7-5.8 femtocuries/kg. for monthly samples for the period July-December 1965. Milk samples collected in a similar manner over a similar period showed concentrations which were not significantly different from zero. Analysis of human tissue samples obtained at autopsy in the greater Boston area during the period August 1965-July 1966 showed concentrations of Pu^{239} in livers ranging 0.21-2.52 picocuries/kg. and in lungs ranging 0.14-1.13 picocuries/kg. Pu^{239} was not detected in bone samples from individual autopsies but was detected in large composite bone samples in concentrations ranging 0.04-0.12 picocurie/kg. (Chem. Abs.)

21
Ozolins, G. and C. Rehmann.
AIR POLLUTANT EMISSION INVENTORY OF NORTHWEST INDIANA. A PRELIMINARY SURVEY 1966. Durham, N. C., Public Health Service, Apr. 1968.

Sources of air pollutant emissions were surveyed to quantify the total pollution load emitted to the air over the northwest Indiana communities of East Chicago, Gary, Hammond, and Whiting. The emissions are reported on an annual basis and subdivided into the 5 major pollutants: particulates, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide. The 4 major source categories that were utilized in reporting emissions from area and paint sources are: fuel combustion in stationary sources, fuel combustion in mobile sources, combustion of refuse, and industrial process losses. The results of this survey are reported by city and illustrated on the grid system established by the Northwest Indiana Air Resource Management Program. (Authors' Abs.)

22
RAPID SURVEY TECHNIQUE FOR ESTIMATING COMMUNITY AIR POLLUTION EMISSIONS. Cincinnati, Ohio, Robert A. Taft Engineering Center, 1967, 77p. (PHS Publ. No. 999-AP-29).

A method is presented for estimating rapidly the major emissions of air pollutants in a community. The method is based on information that is readily available in most urban areas; it does not entail extensive surveys or sampling procedures. Application of this survey method will yield a series of tables, maps, and diagrams that indicate (1) the weights of emissions of selected pollutants, by year and by season; (2) the relative importance of various fuels and types of sources in producing the emissions; (3) the relative amounts of pollutants emitted in various geographic subareas of the community. The rapid survey technique is not meant to replace more detailed surveys where they are needed and where more extensive resources are available. The rapid method will provide reasonable information for making intelligent decisions in air conservation programs in many communities at an earlier time than might otherwise be possible. With rapid method a beginning can be made that should be carefully reviewed and modified with passage of time and the gathering of more detailed information. (APCA Abs.)

23
Venezia, R. and G. Ozolins.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: II AIR POLLUTANT EMISSION INVENTORY. Cincinnati, Ohio, Robert A. Taft Engineering Center, Dec. 1966, 50p.

A survey carried out in the St. Louis area of emissions from the following types of source is described: (1) fuel combustion in stationary sources (power stations, factories and domestic sources), (2) solid waste disposal, (3) transportation sources (road vehicles, aircraft, railways and ships), and (4) industrial process emissions (oil refineries, cement manufacturing, asphaltic concrete manufacturing, steel making, foundries, grain handling and processing, coffee roasting, chemical industry and solvent evaporation). A summary of results obtained is given. (Air Poll. Abs.)

24
Wohlers, H. C. and W. E. Jackson.
AIR POLLUTION EMISSION INVENTORY — PHILOSOPHY AND METHODOLOGY. In: Inst. Environ. Sci., 13th Annual Tech. Meeting, Apr. 10-12, 1967, Washington, D. C. Proceedings, v. II. The Institute, Mt. Prospect, Ill. n. d., p. 613-618.

The emissions inventory of the air pollutants discussed investigates sources, evaluates air pollution control devices, and presents the weight of specific pollutants released in the area on a time basis. The Delaware Valley emission inventory is presented as an example. (Eng. Index)

(a) Industrial

25
Bienstock, D., R. L. Amsler, and E. R. Bauer, Jr.
FORMATION OF OXIDES OF NITROGEN IN PULVERIZED COAL COMBUSTION. Jour. Air Poll. Control Assoc., v. 16: 442-445, 1966.

Nitrogen oxides are a potential atmospheric pollutant. Their formation and decomposition were studied in an experimental pulverized-coal-fired furnace. The concentration of nitrogen oxides (NO_x) was a maximum in the combustion zone and decreased as the combustion gas cooled. At a coal burning rate of 2 lb/hr and 22% excess air, reduction of nitrogen oxides was obtained by selective secondary-air distribution. With 105% of the stoichiometric air fed to the coal-combustion zone and 17% additional air fed just beyond the flame front, 62% reduction of NO_x occurred with good combustion efficiency. Lowering the quantity of excess air lowered the NO_x concentration, but at the expense of combustion efficiency. When 22% excess air was fed to the primary combustion zone, NO_x concentration in the effluent was 550 ppm and carbon in the flyash 2.0%. With 5% excess air, the NO_x concentration fell to 210 ppm and carbon in the flyash rose to 13.8%. With stoichiometric combustion the NO_x was 105 ppm, a reduction of 81% and the carbon was 42.3%. Recirculation of combustion gas was not an effective means of lowering NO_x formation. (Authors' Abs.)

26
Borgwardt, R. H., R. E. Harrington and P. W. Spaite.
FILTRATION CHARACTERISTICS OF FLY ASH FROM A PULVERIZED COAL-FIRED POWER PLANT. Jour. Air Poll. Control Assoc., v. 18: 387-390, June 1968.

The operating characteristics of a pilot baghouse and the filtering characteristics of fly ash filtered from the flue gas of a pulverized coal-fired power plant were studied by techniques developed in the engineering research laboratories of the National Center for Air Pollution Control in Cincinnati. The permeability of the dust cake varied with the operating conditions of the baghouse in a way that significantly affects the pressure drop and power requirements of the system. (Authors' Abs.)

27
Boubel, R. W. and K. R. Wise.
AN EMISSION SAMPLING PROBE INSTALLED, OPERATED, AND RETRIEVED FROM GROUND LEVEL. Jour. Air. Poll. Control Assoc., v. 18: 84-86, Feb. 1968.

The "Teepee" type wood residue incinerator, similar to many other sources, requires sampling at the point where the emissions enter the atmosphere. Because the location of the emission point is hazardous and unpleasant for the operation of a sampling probe, a portable, tilt-up column was developed which permitted installation, operation, and retrieval of the sampling train from ground level. The sampling train developed permitted determination of the size distribution and weight of the particulate emitted by this highly variable source. (Author's Abs.)

28
Brock, J. R.
DIFFUSION TO PARTICLES IN THE NEAR FREE MOLECULE REGION. Jour. Colloid Interface Sci., v. 22: 513-516, 1966.

A linearized model of the Boltzmann equations for a binary gas mixture diffusing to a sphere is solved using the integral iteration method to obtain the 1st-order correction in the inverse Knudsen number to the free molecular flux to the sphere. (Chem. Abs.)

29
Cuffe, S. T. and R. W. Gerstle.
EMISSIONS FROM COAL-FIRED POWER PLANTS: A COMPREHENSIVE SUMMARY. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 30p. (PHS Publ. No. 999-AP-35) (Presented at: Amer. Indus. Hyg. Assoc. Meeting, Houston, Tex., May 1965).

A series of tests on six coal-burning power plants has been conducted to determine certain stack gas components of interest in atmospheric pollution. The six units tested included three dry-bottom pulverized coal-burning units, two wet-bottom units, and a large spreader-stoker traveling-grate unit. Measurements of sulfur oxides indicate that essentially 90-100% of the sulfur in the coal appears as sulfur oxides in the stack gas. Of this amount 1-2% is in the form of sulfur trioxide and the balance is sulfur dioxide. Neither the type of furnace, the conditions of firing, nor the re-injection of fly ash affected sulfur oxide emissions significantly. Concentrations of sulfur oxides are thus essentially determined by the amount of sulfur in the coal entering the furnace. Concentrations of nitrogen oxides varied widely, ranging from 221 ppm for the vertically fired unit to 1204 ppm for the cyclone-type furnace. Concentrations of nitrogen oxides apparently are determined by: (1) initial flame temperatures in the firebox, (2) decomposition in the high-temperature region of the furnace, and (3) quenching of the decomposition reaction as the gases are cooled in the boiler section of the furnace. Control of particulate emissions varied considerably in coal-fired power plants. Combination cyclone and electrostatic-precipitator-type fly ash collectors gave collection efficiencies of about 96% and an outlet grain loading of 0.20 gr/scf at full load. Electrostatic precipitators and mechanical cyclone collectors, when used separately, gave average collection efficiencies ranging from 75 to 85%, with loadings at the fly ash collector outlet varying from 0.19 to 0.68 gr/scf. Additional emissions determined included polynuclear hydrocarbons, carbon monoxide, gaseous hydrocarbons, formaldehyde, and trace metals. None of these components were found in appreciable quantities during normal furnace operating conditions. (Authors' Abs.)

30
Douglass, I. B.
THE CHEMISTRY OF POLLUTANT FORMATION IN KRAFT PULPING. In: Proc. Intern. Conf. Atmos. Emissions from Sulfate Pulping, Sanibel Island, Apr. 28, 1966. Ed. by E. R. Hendrickson. DeLand Fla., E. O. Painter Printing Co., n. d., p. 41-71.

The emission of malodorous compounds from the digester arises: (1) from a stripping of hydrogen sulfide; and (2) from the reaction of sulfide on hydrosulfide ions with the methoxyl groups present in lignin. High temperatures, high sulfidity, and long reaction time all favor the production of the sulfur compounds. Whether the malodorous compounds produced during evaporation is a stripping action or results from additional formation of methyl mercaptan and dimethyl sulfide is not known. The biggest sources of odorous compounds are the direct evaporator (problem may be removed by black liquor oxidation) and the recovery furnace. The recovery furnace is often overloaded causing large quantities of hydrogen sulfide, methylated sulfur compounds, and two- and three-carbon groups sulfur compounds to be emitted. (Author's Abs., modified)

31
Douglass, I. B.
SOME CHEMICAL ASPECTS OF KRAFT ODOR CONTROL. Jour. Air Poll. Control Assoc., v. 18: 541-544, Aug. 1968.

The principal sources of odor in the kraft pulping process are the digester, the direct evaporator, and the recovery furnace. Control of odor from the digester requires the confinement of the noncondensable gases and their destruction by chlorination, burning, or by some other means. Control of odor from the direct evaporator depends on efficient black liquor oxidation. The recovery furnace, which potentially can be the worst source of air pollution, must be operated properly within its rated capacity. The chemistry of various control measures is discussed. (Author's Abs.)

32
Feuerstein, D. L., J. F. Thomas, and D. L. Brink.
MALODOROUS PRODUCTS FROM THE COMBUSTION OF KRAFT BLACK LIQUOR. I. PYROLYSIS AND COMBUSTION ASPECTS. TAPPI, v. 50: 258-262, June 1967. (Presented at: 51st Annual Meeting Tech. Assoc. Pulp and Paper Indus., New York, Feb. 21-24, 1966).

The production of malodors is an undesirable side effect that has always been associated with the kraft pulping process. Such malodors may originate at six major points in the overall digestion and combined recovery (inorganic chemical and heat) and organic waste elimination processes. Based on information in the literature, these points may be listed in order of decreasing contribution to atmospheric pollution: the recovery furnace is the major source, followed by evaporators, digester, lime kiln, oxidation tower, and dissolving tank. In the present study, it was assumed that the recovery furnace operation covers a wide spectrum, such as distillation and sublimation, pyrolysis, auto-oxidation, stoichiometric combustion, and quenching. It was found possible to carry single charges of spent reaction liquors sequentially through the various steps in the laboratory under controlled conditions as well as to quantitatively collect and analyze all products. The contributions from individual, simultaneously occurring processes within a furnace are thus being considered for the first time from the standpoint of air pollution. Several unique control possibilities have been indicated as a result of this work. Results of the work relating to combustion techniques and sample collection are contained in this paper. Analytical methods and a discussion of the results obtained are presented in the second paper of this series.
(Authors' Abs.)

33
George, R. E. and R. L. Chass.
CONTROL OF CONTAMINANT EMISSIONS FROM FOSSIL FUEL-FIRED BOILERS. Jour. Air Poll. Control Assoc., v. 17: 392-395, 1967.

The importance of fuels combustion was brought into sharp focus recently in a report of air pollution to the United States Senate in which it was stated, "These processes replace usable air with potentially harmful pollutants, and the capability of the atmosphere to disperse and dilute these pollutants--especially in urban areas where people, vehicles, and industries congregate in even greater numbers--is strictly limited." The overwhelming burden of sulfur compounds, as well as nitrogen compounds and particulate matter in the U. S. today, originates from the burning of coal and fuel oil in stationary combustion sources. Thus, combustion has a large influence on the quality of the atmosphere in most urban areas. The air pollution effects of these contaminants are many and varied and all are objectionable and undesirable. Without a doubt, the most serious air pollution problem in the nation today is that created by the combustion of fossil fuels. (Authors' Abs.)

34
Gerstle, R. W. and R. F. Peterson.
ATMOSPHERIC EMISSIONS FROM NITRIC ACID MANUFACTURING PROCESSES. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution, 1966, 89p. (PHS Publ. No. 999-AP-27).

Evaluation of emissions from selected chemical manufacturing processes is investigated. The report describes the growth and potential of the HNO_3 industry, the principal processes for production of HNO_3, process variables, emissions from plants under normal operating conditions, and the methods and devices used to limit and control emissions. (Chem. Abs.)

35
Gluskoter, H. J.
CLAY MINERALS IN ILLINOIS COALS. Jour. Sediment. Petrol., v. 37: 205-214, 1967.

Electronic low temperature ashing was used to determine the mineral constitution of Illinois coal. The coal contains kaolinite, illite, and montmorillonite. The low temperature ashing technique, and clay mineral investigation are described. X-ray trace and diffraction patterns of kaolinite and the coals are shown. The distribution of the clay minerals throughout Illinois is discussed. (Chem. Abs.)

36
Hangebrauck, R. P., D. J. von Lehmden, and J. E. Meeker.
SOURCES OF POLYNUCLEAR HYDROCARBONS IN THE ATMOSPHERE. 1967, 44p. (Public Health Service Publ. No. 999-AP-33).

Rates of emissions of polynuclear hydrocarbons were measured at several sources considered likely to produce such emissions. The sources included heat generation by combustion of coal, oil, and gas; refuse burning; industrial processes; and motor vehicles. The annual emissions of benzo(a)pyrene in the United States were estimated for each of the sources surveyed to provide a rough gauge of the importance of each source. Small, inefficient residential coal-fired furnaces appear to be a prime source of polynuclear hydrocarbons; other sources may be of local importance. Production of polynuclear hydrocarbons was generally associated with conditions of incomplete combustion. (Author's Abs.)

37
Hendrickson, E. R. and C. I. Harding.
AIR POLLUTION PROBLEMS ASSOCIATED WITH KRAFT PULPING. Proc. Internat. Clean Air Congr., London (England), Oct. 1966, p. 95-97.

Sources of air pollution from pulping and recovery operations in the kraft paper manufacturing process, including furnace, evaporator and blow gases, are defined; the various solid and gaseous products are enumerated, and problems, such as odor, corrosion, and fallout, are discussed. Bibliographic references are given on current research into the abatement of atmospheric emission. Some new or possible developments in process technology relating to emission control are discussed in more detail: these include processes connected with black liquid oxidation; the use of surface condensers on blow gases and evaporator vapors with stream-stripping of condensates; the replacement of direct-contact evaporators with hot air cascade evaporators; processes of continuous digestion to reduce problems associated with batch digestion; and improved monitoring of furnace operations. (Chem. Abs.)

38
Huffstutler, K. K.
SOURCES AND QUANTITIES OF FLUORIDES EVOLVED FROM THE MANUFACTURE OF FERTILIZER AND RELATED PRODUCTS. Jour. Air Poll. Control Assoc., v. 16: 682-684, Dec. 1966.

Fluoride emission rates from the manufacture of phosphoric acid, run-of-pile triple super-phosphate, diammonium phosphate, and granular triple super-phosphate are presented in tabular form. Fluoride emissions from the manufacturing or producing of related phosphatic products such as defluorinated and calcined phosphate rock, normal super-phosphate, super-phosphoric acid, and elemental phosphorus are also discussed. (APCA Abs.)

39
Jimeson, R. M.
UTILIZING SOLVENT-REFINED COAL IN POWER PLANTS. Chem. Eng. Prog., v. 62: 53-60, 1966.

Solvent-refined coal decreases the emission of S oxides in the power plant products of combustion. The ash is reduced from 7 to 0.14% and S from 3.27 to 0.95% by the refining process. The economic aspects of the process are discussed. (Chem. Abs.)

40
Kaiser, E. R.
PROSPECTS FOR REDUCING PARTICULATE EMISSIONS FROM LARGE INCINERATORS. Combustion, v. 38: 27-29, Aug. 1966.

By burning the refuse in boiler furnaces at low excess air, and generating steam, the volume of flue gas to be cleaned is reduced to a minimum. Where high efficiency of flue-dust collection is required, steam generation from a refuse firing permits a major saving on the cost of dust collection. (APCA Abs.)

41
Kaiser, E. R.
THE SULFUR BALANCE OF INCINERATORS. Jour. Air Poll. Control Assoc., v. 18: 171-174, Mar. 1968.

Municipal refuse usually contains only 0.10-0.15% sulfur. During combustion a minor fraction of the sulfur is released as SO_2, while the major fraction is fixed in the ash, which contains alkaline oxides. Contrasted with coal and heavy fuel oil, municipal refuse is a minor to negligible source of SO_2 air pollution. (Author's Abs.)

42
Kittle, R. W.
CURRENT STATUS AND FUTURE PROSPECTS FOR PULP MILL AIR POLLUTION CONTROL. 1966, p. 232-235. (Public Health Service Publ. No. 1649).

Characteristic emissions are identified. These include primarily fly ash, S-containing compounds and materials characterized by obnoxious odors. General factors involved in control of these pollutants are discussed. (Chem. Abs.)

43
Kreichelt, T. E.
AIR POLLUTION ASPECTS OF TEPEE BURNERS USED FOR DISPOSAL OF MUNICIPAL REFUSE. Public Health Service, Sept. 1966, 35p. (PHS Publ. No. 999-AP-28).

An evaluation study was made of air pollution emissions based upon extensive literature search and field trips to 15 tepee burners in six states. Smoke as a function of composition and rate of charge was observed, and the effect of burner charging methods, construction, and operational procedures on smoke emissions recorded. None of the tepee incinerators observed in operation meet normal visible emission limitations of air pollution control ordinances of most municipalities. Nuisance problems from flyash fallout can be expected within distances of up to 1290 ft downwind from operating tepee. (Eng. Index)

44
Kreichelt, T. E., D. A. Kemnitz, and S. T. Cuffe.
ATMOSPHERIC EMISSIONS FROM THE MANUFACTURE OF PORTLAND CEMENT. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 47p. (PHS Publ. No. 999-AP-17).

This report summarizes the information on actual and potential atmospheric emissions from the manufacture of cement. Raw materials, process equipment, production processes, plant locations, and process trends are described. The kiln operation and the drier used in dry process plants are the 2 main sources of dust emissions. Dust generated in the dry-process kiln may vary in the range 1-25% of finished cement; from the wet process, 1-33%. SO_2 emissions from the kiln operation are generally minor. In the wet process, an odor problem may arise from heating certain types of raw material such as marine shells, marl, clay, or shale. Electrostatic precipitators or fiber-glass fabric filters can adequately collect the dust from the hot kiln gases. In many plant designs, multicyclones precede the precipitator or fabric filter. Precipitators or low-temperature fabric filters alone may be adequate on other unit operations. Dust emissions as low as 0.03-0.05 grains/standard ft^3 were obtained in newly designed well-controlled plants. (Chem. Abs.)

45
Loquerco, P. and W. J. Stanley.
AIR POLLUTION POTENTIAL FOR COFFEE ROASTING. Air Eng., v. 9: 22-29, Nov. 1967.

The 1965 Emission Inventory for Chicago shows that almost 350,000 lb. of green coffee beans are processed each day in 9 sq. miles of a densely populated part of the city by 15 companies operating 55 roasters — the chief air pollution source in the process. All but three of the companies have at least one control device (cyclone) to reduce their emissions. Total emissions for the entire industry are estimated as approximately 50 tons of particulate and account for numerous nuisance complaints resulting from fume and odor discharge. This paper describes the six steps in coffee processing and the types of pollution arising from three of them—dust and trash from the precleaning stage, fumes and odors from the roasting stage, and small amounts of chaff and residual smoke from the final cleaning of the roasted beans—and suggests methods of abating them. (Air Poll. Abs.)

46
McKean, W. T., Jr., B. F. Hrutfiord, K. V. Sarkanen and others. EFFECT OF KRAFT PULPING CONDITIONS ON THE FORMATION OF METHYL MERCAPTAN AND DIMETHYL SULFIDE. Tappi, v. 50: 400-405, 1967.

Available data are given on the formation of MeSH and Me_2S during sulfate pulping is reviewed, leading to improved kinetic analysis of these reactions for softwoods. The summative rate of MeSH and Me_2S formation is proportional to the initial hydrosulfide concentration. Larger amounts of the odorous compounds are produced from hardwoods due to rapid initial demethylation of some labile MeO groups. In softwood cooks, the formation of Me_2S is reduced by short, high-temperature cooks, while the temperature effect on mercaptan formation is rather insignificant. More effective reduction of odor formation is obtained by lowering the sulfidity and by keeping black liquor recycling at a minimum. Rate constants for demethylation of lignin models by MeSH were ~ 20% of the constants observed with softwood, indicating either a poor model choice or the formation of a demethylation catalyst during delignification. (Chem. Abs.)

47
Murray, F. E. and H. B. Rayner.
EMISSION OF HYDROGEN SULFIDE FROM KRAFT RECOVERY FURNACES. Pulp and Paper Magazine of Canada (Gardenvale, Que.), v. 69: T137-T140, 1968.

H_2S emission in flue gases from kraft mill recovery furnaces was examined as a function of the Na_2S and total solids content of the black liquor feed and rate of liquor flow, O content of the flue gas and the total, primary, and secondary air flow to the frunace. The emission of H_2S increased sharply above a liquor flow rate of 200 gal./min. but this figure probably varies greatly for different types of furnaces and modes of operation. Increasing either the O content of the flue gas or the amount of secondary air to the furnace caused the H_2S emission to decrease fairly linearly to a low value, below

50 μg./1., and then level off close to 0. No significant relation was found between the H_2S emission and primary air to the furnace or to the Na_2S content of the black liquor. (Chem. Abs.)

48
Nolan, W. J.
PREIMPREGNATION AND HIGH LIQUOR RATIOS IN KRAFT PULPING. Paper Trade Jour., v. 150: 56, 1966.

Preimpregnation in kraft pulping with active alkali is not desirable, because cellulose degradation and pulp quality is decreased. High liquor ratios are not necessary to high-speed pulping. (Chem. Abs.)

49
Perry, H. and J. A. DeCarlo.
THE SEARCH FOR LOW-SULFUR COAL. Mech. Eng., v. 89: 22-28, 1967.

Increasing attention by coal consuming industries to air pollution by suflur oxides has led to a study of the availability of low-suflur coals. Reserves of high-grade coal are large. The largest reserves of low-sulfur coals are west of the Mississippi; large blocks of low-sulfur coal in the Appalachian region are under long-term contracts to the steel industry. Where coal is used only for its heating value, it is strongly competitive with other fossil and nuclear fuels, and any increase in delivered cost due to reduction in sulfur could have adverse economic effects. Methods for preventing the emission of sulfur oxides from coal combustion products are available, but costs are high. Removal of the pyritic sulfur from coal at the point of use may be feasible, but additional research and development are required. Addition of limestone or dolomite offers the possibility of some reduction in sulfur oxide emissions and is particularly applicable to existing plants where space is insufficient for new equipment for other proposed methods. Removal moval of sulfur oxides from stack gases at high temperatures is promising, but costs are still quite high, with the possibility of reduced costs in the future. (Chem. Abs.)

50
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ATMOSPHERIC EMISSIONS FROM SULFATE PULPING. Sanibel Island. Apr. 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n. d., 382p.

Various aspects of current knowledge regarding the sources, effects, and control of kraft pulp mill atmospheric emissions and the identification of current research needs are discussed.

51
Rohrman, F. A., B. J. Steigerwald, and J. H. Ludwig.
INDUSTRIAL EMISSIONS OF CARBON DIOXIDE IN THE UNITED STATES: A PROJECTION. Science, v. 156: 931-932, 1967.

CO_2 builds up in the earth atmosphere principally from increased use of fossil fuels. Estimates of the escalating uses of fossil fuels in the United States, especially for the generation of electric power and in the internal combustion engine, show that by the year 2000 emissions will have increased approximately 18-fold from 1890. In the period 1965 to 1985 an emission-rate increase of around 4.0%/year compounded is expected. The expected intrusion and expansion of nuclear power will tend to lower the rates of increase of emission after 1985. Increases in emission rates in the rest of the world will probably equal or exceed the values projected for the United States. (Chem. Abs.)

52
Rohrman, F. A., B. J. Steigerwald, and J. H. Ludwig.
SO_2 POLLUTION — THE NEXT 30 YEARS. Power, v. 111: 82-83, May 1967.

Public Health Service studies indicate that sulfur dioxide emission levels in the United States will more than double within 20 years and this pollution will come primarily from combustion of coal and oil in power plants. Additional sources include coal and oil combustion for processes other than power plant operations, ore smelting operations, and petroleum refining operations. The potential for increased emissions of sulfur dioxide in the future is tremendous. Rate of increase should decline after 1970 as result of nuclear plants replacing obsolete plants, and absorbing many new load requirements; actual decrease in emission levels is anticipated after 1990. (APTIC Abs.)

53
Springer, K. J. and R. C. Stahman.
AN INVESTIGATION OF DIESEL POWERED VEHICLE ODOR AND SMOKE — A PROGRESS REPORT. (Presented at: Nat. Petroleum Refiners Assoc. Paper, Fuels and Lubricants Meeting. Sept. 15-16, 1966, 23p.)

Under a large program of the U.S. Public Health Service to investigate Diesel-engine emissions, the Southwest Research Institute has been commissioned to determine those vehicle operating conditions which produce significant levels of odor and smoke and to develop procedures and methods of quantitative smoke-and-odor measurement in the laboratory. The paper describes facilities and equipment developed for this purpose. Since there is no objective method of measuring Diesel-exhaust odor, dilute exhaust samples are presented to a panel of ten persons who assess them against a reference in the form of a quality/intensity kit. These tests are carried out in a special "odor facility" which is described in detail. To obtain information on the natural dilution of Diesel-vehicle exhaust gas under various operating conditions, a system was designed by which a known flow of trace gas is introduced into the vehicle tail-pipe and its concentration in the atmosphere is continuously measured. The trace gas is $C\ Cl_2F_2$. The U.S. Public Health Service is also developing a smoke-meter similar to the French U.T.A.C. meter and the meter under evaluation by the State of California. The meter is sensitive to both thickness of the smoke plume and number of smoke particles per unit volume. (Air Poll. Abs.)

54
Stern, A. C.
THE REGULATION OF AIR POLLUTION FROM POWER PLANTS IN THE UNITED STATES. Revue de la Société Royale Belge des Ingenieurs et des Industriels (Bruxelles), No. 11: 457-470, 1966.

Steam power plants produce the following percentages of total pollutant emissions in the U.S.: CO 0.8, S oxides 45.0, hydrocarbons 0.7, particulate matter 20.0, N oxides 30.0 and miscellaneous 5.0. Federal law states that the primary responsibility of air pollution prevention and control at the source rests with the states and local governments. The manner in which the states have assumed this responsibility is reviewed briefly. The permit and registration systems are used by very few of the states but are used extensively by the larger city and county air pollution control agencies. Information presented on the use of the Ringelmann scale indicates a tendency to stricter smoke emission limits. Fewer U.S. jurisdictions limit fly ash emission but the trend is toward limits < 0.5 lb./10^6 Btu. In only one major case does stack height enter into its fly ash emission regulation. Only Colorado, New York, and Oregon, have adopted ambient air quality standards for suspended or settled particulate matter. Since 1957 suspended particulate matter in all large U.S. cities have been measured. Emission inventory techniques have been developed to the point that estimates of particulate matter emission can be made for each class of contributor in the community. Steam power plants are in the class most amenable to reduction. Sulfur oxide emission standards are reviewed. No state has, as yet, established limits on sulfur content of fuels. No U.S. jurisdiction has issued regulations limiting the emission from power plants of CO, hydrocarbons, or nitrogen oxides but it seems only a matter of time before regulation of oxides of nitrogen from power plants is required. The "alert levels" established by New York and Los Angeles areas for emergency situations are reviewed. Higher stacks are not the solution to the problem. The Federal role in the abatement of air pollution is discussed. A look to the future indicates that by the year 2000, SO_2 emissions will be greater by a factor of 3 than at present and that power plants will become the predominant source of SO_2. The implications of these and related projections are discussed. (Chem. Abs.)

(b) Non-industrial

55
Cadle, R. D.
ROLE OF METHYLENE IN THE PRODUCTION OF ATMOSPHERIC TRITIATED METHANE. Jour. Geophys. Res., v. 72: 2251-2253, 1967.

Experiments are described which indicate that the formation of CH_3T in the atmosphere via CH_2 reactions is very unlikely. (Chem. Abs.)

56
Cadle, R. D., W. S. Fischer, E. R. Frank and others.
PARTICLES IN ANTARCTIC ATMOSPHERE. Jour. Atmos. Sciences, v. 25: 100-103, Jan. 1968.

Samples of airborne particles were collected for analysis to determine whether high relative concentrations of sulfate occur in aerosols of the south polar as well as the north polar region. The samples collected by impaction in the Antarctic near the earth's surface during November and December, 1966 contained much higher concentrations of sulfur than similar samples collected in most parts of the world. Most samples contained little sodium chloride. Some possible explanations for the high sulfur to chlorine ratio are suggested. Electron micrographs are included. (Eng. Index)

57
Cadle, R. D., A. F. Wartburg, E. R. Frank and others.
PARTICLES IN VOLCANIC FUME. Nature, v. 213: 581, 1967.

The impactor samples are agglomerated droplets that remained liquid at a relative humidity of 30% and consisted of supersaturated aqueous solutions of a crystal solid. (Chem. Abs.)

58
Darley, E. F., R. F. Burleson, E. H. Mateer and others.
CONTRIBUTION OF BURNING OF AGRICULTURAL WASTE TO PHOTOCHEMICAL AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 16: 685-690, 1966.

Agricultural wastes from orchards, grain fields, and range lands are burned each year in California as the most practical means of ridding the land of these wastes. In order to determine the relative contribution of the burning of such material to photochemical air pollution, the effluent from 123 fires of known weights of range brush, both dry and green, barley and rice stubble, and prunings from various fruit and nut trees were monitored in a special tower which provided an open burning situation. Analyses were made for total hydrocarbon, expressed as C, by flame ionization detection, and for 24 individual hydrocarbons by gas chromatography, as well as for CO and CO_2 by infrared spectroscopy. A few analyses were made for oxides of nitrogen. These data, coupled with temperature and airflow measurements, allowed calculations to be made on pounds of effluent per ton of material burned and demonstrated that the emissions from agricultural burning are much less than those from the automobile, a principle source of such emissions. (Authors' Abs.)

59
Duce, R. A., J. W. Winchester, and T. W. van Nahl.
IODINE, BROMINE, AND CHLORINE IN WINTER AEROSOLS AND SNOW FROM BARROW, ALASKA. Tellus, (Stockholm), v. 18: 238-248, 1966.

I, Br, and Cl were determined in atmospheric aerosols and snow, by using neutron activation analysis, at Barrow, Alaska. I/Br concentrations were 0.1-0.2 g. I/g. Br. Cl varied from <.02 to 4.0 μg Cl/m^3. Br was 1-30 nanog./m^3, and I was 0.3-10 nanog./m^3. The ratios I/Cl and Br/Cl increase sharply with decreasing Cl. Halogen concentrations decrease with increasing distance from the sea up to 10 km. (Chem. Abs.)

60
Duce, R. A., A. H. Woodcock, and J. L. Moyers.
VARIATION OF ION RATIOS WITH SIZE AMONG PARTICLES IN TROPICAL OCEANIC AIR. Tellus (Stockholm), v. 19: 369-379, 1967.

Size fractions, ~0.3- > 10 μ, of sea-salt particles were collected in the marine atmosphere by using a 6-stage cascade impactor mounted on a tower 14 meters above the windward shoreline near Hilo, Hawaii. I, Br, and Cl analyses were performed on 8 sets of samples by neutron activation. The I/Cl ratio showed a regular increase by a factor of 50 to 100 from the largest to the smallest particles. On the smallest particles this ratio was approximately a thousand times that in sea water. The Br/Cl ratio showed a minimum at intermediate particle sizes, with a majority of the values below the sea water ratio. Most of the I mass was found on particles with radii of ~0.6 μ, whereas the majority of the Cl and Br was on particles with radii 1.25-2.25 μ. The most obvious conclusion is that a regular variation of the I/Cl ratio with changing particle size definitely exists. Differences in the I/Cl ratio may also aid in tracing temporal, geophysics, and other changes in the microphysics of droplet formation in the air-sea boundary layer. This information provides a possible method for tracing the role of sea-salt nuclei in preparation processes, and may be used to gain new insight into the cycle of the halogens between the atmosphere and the sea. (Chem. Abs.)

61
Gerstle, R. W. and D. A. Kemnitz.
ATMOSPHERIC EMISSIONS FROM OPEN BURNING. Jour. Air Poll. Control Assoc., v. 17: 324-327, 1967.

Emission data have been derived from the simulated open burning of municipal refuse, landscape refuse, and automobile components. The data confirm that disposal of refuse by open, uncontrolled burning invariably leads to higher emissions than incineration and creates an unnecessary air pollution problem. (Authors' Abs.)

62
Holmes, B., W. E. Sandine, and P. R. Elliker.
SOME FACTORS INFLUENCING CARBON DIOXIDE PRODUCTION BY LEUCONOSTOC CITROVORUM. Appl. Microbiol., v. 16: 56-61, 1968.

This study was undertaken to determine whether L. citrovorum plays a role in CO_2 production in milk. The ability of L. citrovorum strains to produce gas was studied by 2 methods. A qualitative method, in which an agar plug was forced up the neck of a volumetric flask, measured gas visually. This method demonstrated that 0.25% yeast extracted in a milk medium at 30°, stimulated the production of at least 10 milliliters of gas. Studies using a differential respirometer revealed that L. citrovorum produced 500-900 µl. of CO_2 in 6.5 hour, whereas 800 to 1500 µl of CO_2 were produced in nonfat milk which contained 0.33% yeast extracted. Cell extracts of Streptococcus cremoris, S. lactis, Lactobacillus lactis, L. casei, and L. helveticus also enhanced gas production by L. citrovorum from 20 to 70%. Autolyzates of these bacteria, present during the ripening or ageing of certain cheeses, may stimulate Leuconostoc citrovorum, a common organism in starter cultures, to produce gas, causing, for example, the slit-open defect of Cheddar cheese. Yeast extracts caused an increase in acid and gas production per cell but did not cause an increase in growth. Experiments indicated that 1 metabolic source of CO_2 was the decarboxylation of pyruvate produced during catabolism of citric acid. Yeast extract stimulated this reaction by 16%. (Chem. Abs.)

63
Meland, B. R., and R. W. Boubel.
A STUDY OF FIELD BURNING UNDER VARYING ENVIRONMENTAL CONDITIONS. Jour. Air Poll. Control Assoc., v. 16: 481-484, 1966.

A field study on grass field burning was conducted in the Willamette Valley of Oregon during the summer of 1965. Approximately 230,000 acres of grass fields were burned in the valley during Aug. and Sept. Serious air pollution problems resulted from this burning. The purpose of the study was to determine the effect of environmental variables on grass field burning and to determine if conditions exist when significant air pollution reduction can be achieved. The environmental variables investigated were time from harvest to burning, time of day, air temperature, relative humidity, soil and straw moisture, wind speed and direction, and fuel density. The dependent variables measured were particulate emission and size distribution, combustion temperature, burn rate, amount of ash, percent of organics in the particulate, and smoke appearance. The results were analyzed statistically to determine the significant variables and their relationship. (Authors' Abs.)

64
Pearson, J. E.
NATURAL ENVIRONMENTAL RADIOACTIVITY FROM RADON-222. 1967. 31p. (Public Health Service Publ. No. 999-RH-26).

Measurements were made of ^{226}Ra and ^{222}Rn by using a de-emanation method in which the gaseous daughter, ^{222}Rn, is collected and analyzed by an α-scintillation method. Emanating ^{226}Ra from particles of soil in clay type soils varied from 0.342 x 10^{-12} to 0.690 x 10^{-2} g./g. dry soil. Sandy soils varied between 0.147 x 10^{-2} and 0.244 x 10^{-12}. Highest activity measured was 14.3 x 10^{-12} g. of emanating ^{226}Ra/g. of dry soil containing U ore. Emanation from the ground in Champaign County, Illinois, for 216 measurements, was (140 ± 73) x 10^{-18} Ci. of ^{222}Rn/cm^{2}-sec. Other soils released similar values of ^{222}Rn except at locations where ^{238}U is available in significant amounts. Release of ^{222}Rn from leaves of corn (Zea mays) about midday and near the growth peak was ~2.6 times that of the soil under the corn at Argonne National Laboratory in a series of 6 tests. Concentrations of ^{222}Rn in the atmosphere were measured in 8 series of 24-hr tests, to elevations of 16 m. Values of concentration at various times of the day are presented for the normal environmental levels. (Chem. Abs.)

65
Pearson, J. E. and G. E. Jones.
SOIL CONCENTRATIONS OF "EMANATING RADIUM-226" AND THE EMANATION OF RADON-222 FROM SOILS AND PLANTS. Tellus (Stockholm), v. 18: 655-662, 1966. (Presented at: C.A.C.R. Symposium, Atmospheric Chemistry, Circulation and Aerosols, Visby, Sweden, Aug. 18-25, 1965).

The primary purpose of the research reported herein was to determine the uniformity of emanation of radon-222 from soils in Champaign County, Illinois, in order to judge its suitability for use as a tracer material for studies of vertical diffusivity. This study has had three areas of effort: (1) soil "emanating radium-226" concentrations, defined as the quantity of that material, the parent of radon-222, sufficiently near the surface of soil particles that it is capable of releasing radon into the pore spaces between the particles. That portion is not of interest; (2) the emanation of radon-222 from soils, its variation with location, soil type, wind speed, turbulence, soil moisture, pressure, etc., and (3) the release to the atmosphere of radon-222 by leaves of plants. The emanation of radon-222 from soils was studied. Factors investigated which affect the rate of emanation include wind speeds across the surface, atmospheric turbulence, soil moisture, soil type and location. Values of emanation and concomitant variation in these factors are reported. An investigation of radon-222 release from leaf surfaces was initiated; preliminary results of this study are reported. Measured values of radium-226 in the soil capable of giving rise to diffusing radon were found to vary 70-fold in different geological regions but were uniform in Champaign County, Illinois, the content being (0.64 plus or minus 0.09) x 10^{-12} grams of "emanating radium-226" per gram of soil. The emation rate of radon-222 from soils into the atmosphere varied 1000-fold among geographical regions but was shown to be uniform in Champaign County, averaging (140 plus or minus 73) x 10^{-18} curies per square centimeter per second. The findings of the research indicate that radon-222 may be used successfully as a cost-free tracer in studies of vertical diffusion in Champaign County, Illinois. (APTIC Abs.)

66
Stephens, E. R., E. F. Darley, and F. R. Burleson.
SOURCES AND REACTIVITY OF LIGHT HYDROCARBONS IN AMBIENT AIR. Proc. Div. Refining, Amer. Petrol. Inst., v. 47: 466-483, 1967.

Recent measurements of low molecular weight hydrocarbons in ambient air samples are described. The disappearance of individual hydrocarbons under irradiation with artificial and natural sunlight in such samples was also measured. Substantial reaction of both olefins and paraffins occurs during the course of irradiation for 1 day. Although the reactivity of the olefins is higher than that of the paraffins, the latter group makes a significant contribution to total reactivity because the amount initially present is relatively large. The anomalously large amounts of the lightest paraffins (propane in particular) was further investigated by analyzing samples near and far removed from oil fields. The results did not clearly reveal the source of these paraffins but it now seems probably that gasoline evaporation, natural gas leakage, and oil field losses may all contribute. A correlation technique permitted the identification of natural gas in some sets of early morning ambient air samples. (Chem. Abs.)

67
Williamson, J. E., R. J. MacKnight, A. B. Wetsley and others.
INCINERATION. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by I. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 413-503. (PHS Publ. No. 999-AP-40).

Disposing of combustible refuse and garbage is a problem in most urban societies. Single chamber incinerators are a cause of air pollution. Various other incinerators (multiple-chamber, general-refuse, mobile multiple-chamber, multiple chamber for burning wood waste, flue-fed apartment, and pathological waste incinerators) are presented as alternatives to the single chamber incinerator. The alternative incinerators are analyzed with respect to the air pollution problem, design procedures, general construction and other pertinent details. Also discussed are special situations: (1) debonding of brakeshoes and reclimation of electrical equipment windings, (2) drum reclamation furnaces, and (3) wire reclamation.

68
Windom, H., J. Griffin, and E. D. Goldberg.
TALC IN ATMOSPHERIC DUSTS. Environ. Sci. & Technol., v. 1: 923-926, 1967.

The mineral talc has been observed in dusts recovered directly from the atmosphere and in the solid mineral phases of rain and snow. The talc, where detected, attains levels of the order of a per cent by weight in the solid phases. This talc probably arises from agricultural activity where the mineral is used as a carrier and diluent for pesticides. The amounts of talc found in atmosphere dusts appear to reflect a local introduction rather than a generalized global fallout. (Chem. Abs.)

(c) Transportation

69
Barak, M.
EUROPEAN DEVELOPMENTS OF POWER SOURCES FOR ELECTRIC VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 105-119. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Several European companies are exploring possible uses of fuel batteries for electric traction with the system generally chosen being the low-temperature hydrogen-oxygen (or air) cell. Although none of these developments has yet reached the stage where it could be adopted for passenger vehicles, they should supply data for proper feasibility studies in the near future. Some of these systems could meet many of the requirements but none could be made at a cost anywhere near a limit of $56 per kilowatt. Much of the capital cost of fuel cells is absorbed in the noble metal catalysts. Some progress is being made in reducing the amount necessary, but this is slow and the search for cheap alternatives that could be used with cheap low-grade fuels has not so far achieved a breakthrough. The materials of construction and other components also appear to make the cost prohibitive. Whether these problems can be solved will depend on the progress made during the next few years. (APTIC Abs.)

70
Bethune, A. J. de
ELECTROCHEMICAL SYSTEMS. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 155-171. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Starting with basic electrochemical and thermodynamic relations, standard voltages and theoretical maximum energy densities were calculated. These characteristics tabulated for 29 possible anodes of 15 chemical elements and 21 possible cathodes of 13 chemical elements. The reference electrodes chosen as a basis for comparison include two anodes: lithium and zinc-zinc hydroxide, and two cathodes: fluorine and sulfur. Calculated values of the combined activation and polarization unit area resistances of electrodes with various given Tafel constants and Transport constants are tabulated as a function of current density. The roles of corrosion and cell uniformity are considered. (APTIC Abs.)

71
Bolt, J. A.
[A DISCUSSION OF] AIR POLLUTION AND ITS REDUCTION IN FUTURE AUTOMOTIVE POWER PLANTS. (Presented at: Soc. Automotive Engineers, Detroit Sect. Meeting, Nov. 6, 1967, 15p. Paper No. 680191).

The amount of pollution contributed in the U.S. by transportation and other sources; government responsibility; industry action and responsibility; energy sources; energy conversion systems; requirements of an automotive powerplant; emissions from gasoline engines; the possibility of reducing emissions by improved engine design and/or changes in gasoline; demonstrated and predicted emission reductions effected by current and proposed exhaust control systems; the stratified-charge spark-ignited engine; the diesel engine; gas turbine engines; the Wankel or rotary engine; electric vehicles, with comparisons of battery systems; fuel cells; and a comparison of different types of powerplants are discussed in terms of performance. Graphs and tables are included. (Abs. Refining Lit.)

72
Bolt, J. A.
FUTURE AUTOMOTIVE ENGINES - AND AIR POLLUTION.
In: Public Health Service, Nat. Conf. Air Poll., Dec. 12-14, 1966. Paper A-11, 23p.

This paper discusses methods of reducing exhaust emissions from conventional engines, e.g., by improved fuel- and air-induction systems, the potentialities of gas turbines, batteries, and fuel cells and their likely effects on air pollution. Principal conclusions are that: (1) reduction of air pollution during the next twenty years will result mainly from improvements in conventional engines; (2) batteries will achieve very limited application until they provide much greater energy and power density at greatly reduced cost; (3) fuel cells may offer better long-term prospects than batteries if the catalytic processes can be elucidated and a hydrocarbon fuel used. (Air Poll. Abs.)

73
Bolt, J. A. and M. Roerma.
CARBURETOR IS ONE KEY TO EXHAUST EMISSION PROBLEM.
Jour. Soc. Automotive Engineers, v. 75: 42-44, May 1967.

Fuel/air ratio is the predominant factor determining the quantity of unburned hydrocarbons, carbon monoxide, and oxides of nitrogen in exhaust emissions of gasoline engines. This makes accurate carburetor metering highly important in view of the air pollution problems. Changes in inlet pressure and temperature have a marked effect on carburetor performance. Devices for maintaining a nearly constant mixture ratio at various air pressures and temperatures are available, but would add to the cost and complexity of the carburetor. It might therefore be better to consider gasoline-injection systems, which can more readily be designed for changes in the barometric pressure and temperature than can float carburetors. (APTIC Abs.)

74
Conlee, C. J., P. A. Kenline, R. L. Cummins and others.
MOTOR VEHICLE EXHAUST AT THREE SELECTED SITES.
Arch. Environ. Health, v. 14: 429-446, 1967.

Increasing awareness that motor vehicles are a significant source of air pollution has led to expanded research concerning their contribution to ambient air pollution. A comparison of pollutant concentrations at selected sites gives a basis to approximate vehicular contributions. To provide a comparison for different traffic densities and dispersion characteristics, three sites were studied: (1) the Sumner Tunnel between Boston and East Boston, Mass, a tunnel carrying a large traffic volume in a controlled environment; (2) the International Peace Bridge across the upper Niagara River between Fort Erie, Ontario, and Buffalo, N. Y., a bridge carrying much traffic under normal conditions; and (3) Laidlaw Ave. near the Air Pollution Research Facility in Cincinnati, a site along a typical urban street. For uniformity of procedure, work was conducted by the same personnel using the same equipment and techniques for all three sites. The study was formulated with the objectives of monitoring pollutant concentrations, traffic conditions, and meteorological variables at each site. Pollutant levels at the three sites were compared to assess the importance of vehicular exhaust on ambient air pollution levels. (Authors' Abs.)

75
Dantowitz, P. and L. Gaddy.
A STATE-OF-THE-ART AUTOMOTIVE FUEL CELL. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 297-306. (PHS Publ. No. 999-AP-37). (Presented at the Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

A hydrazine-air fuel cell module that when used in multiples provides power to drive an M-37 Army truck is described. The peak acceleration of the vehicle equipped with four fuel cell modules and a supplementary lead-acid battery pack is compared with that of a truck equipped with the standard 94-horse-power gasoline engine. With only 20 kws of fuel cell capacity the truck readily climbed grades of 20%. The maximum speed on a good level road was 47 mph. Fuel consumption was between 10 and 15 miles per gallon of hydrazine menohydrate; that of a standard M-37 vehicle is 7 miles/gal of gasoline. The reliability of the fuel cell has been good in the 120 hr it has been used. As installed in the truck the hydrazine-air fuel cell system (excluding the motor and controller) gives a very high energy density, nearly 350 w-hr/lb of an 18-hr mission. For an 8-hr mission the energy density drops to 210 w-hr/lb, still much higher than is offered by any other readily available system. The successful operation of the M-37 truck with a system having such a high power density must be considered an important step forward in the practical application of fuel cells. Using the hydrazine-air system, the Army has gained valuable experience in the operation and control characteristics of an electric vehicle. The relative simplicity and ease of operation of this large hydrazine-air fuel cell power plant has been demonstrated. (APTIC Abs.)

76
DeWitt, T. W.

A SODIUM-SULFUR SECONDARY BATTERY. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 277-287. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

The sodium-sulfur secondary battery is described. The open-circuit potential of the sodium-sulfur system is graphically illustrated as a function of composition. The voltage remains constant at 2.08 until a composition corresponding to sodium penta-sulfide is reached. It then drops almost linearly to 1.76 at a composition corresponding to sodium trisulfide. The temperature of operation is dictated by the melting point of the product, and the constraints thus imposed are illustrated in the phase diagram for the system Na_2S-S. The heart of this battery concept is the ionically conducting solid electrolyte around which most of the research centered. A crystalline material known as beta-alumina was encountered and recognized as having the sought-after properties. Beta-alumina is not a form of Al_2O_3, but is a sodium aluminate with the generally accepted formula $Na_2O.11Al_2O_3$. The electrical resistivity of the formed polycrystalline ceramic is shown. At 300 °C the resistivity is about 5 ohm-cm, which is comparable to the values for molten salts and aqueous sulfuric acid and potassium hydroxide. The cell reaction is simple; it has no gaseous reactants or products and no known side reactions or mechanisms for self discharge. No auxiliary equipment is required except thermal insulation. This battery is still in the advanced laboratory stage, and current emphasis is on obtaining data necessary for proper design of larger units. Three hundred and fifty pounds of sodium-sulfur battery in a 1350-lb commuter car should allow it to cruise at 40 miles an hour for 200-300 miles, at 60 miles an hour for 125-200 miles, and have a top speed of about 70 miles an hour. Such a car's performance should be adequate in an urban-suburban environment. The chief disadvantage of this battery, even for motive power use, is the high temperature of operation. The battery is inoperative at room temperature, so a cold start is impossible, unless auxiliary heating is used. The one thing that must be prevented, of course, is the escape of hot sodium and sulfur from the container in the event of an accident. (APTIC Abs.)

77
Douglas, D. L.
LEAD-ACID BATTERIES AND ELECTRIC VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 201-208. (PHS Publ. No. 99-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Four of the most important commercial lead-acid batteries which are being used for electric propulsion are flat plate motive power; turbular motive power; golf-cart; and starting, lighting, and ignition (SLI) batteries. The discharge characteristics of each are graphically illustrated. Electric street vehicles today, improved lead-acid batteries, and cost are considered. It is concluded that for the next 5 to 10 years only the lead-acid battery will be used in significant numbers of electric street vehicles. Passenger vehicles will perform better than the current "research" vehicles but their performance will be marginal compared to that of gasoline-engine-powered automobiles. Delivery trucks may fare better if urbanization trends continue. (APTIC Abs.)

78
Eisenberg, M.
HIGH-ENERGY NON-AQUEOUS BATTERY SYSTEMS FOR ELECTRIC VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 209-223. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

After a brief review of the technical and economic requirements of electro-chemical power sources for electric vehicles, the potential applicability of devices within the following six classes is explained: (1) fuel cells operating on a storable fuel and using air as a cathodic depolarizer (oxidizer); (2) electrically regenerative fuel cells, i. e., devices fundamentally analogous to a storage battery; (3) metal-air hybrid cells; (4) rechargeable battery systems of the aqueous type (room temperature); (5) rechargeable battery systems of the fused salt type (high temperature); and (6) high-energy battery systems of the nonaqueous type (room temperature). Consideration was limited to the following four criteria: energy, density, cost per mile, safety, and public acceptance. On the basis of fundamental considerations of energy density, if the fused salt, high-temperature system is eliminated only the lithium-anode-base organic electrolytic batteries appear to offer an approach toward an energy density of at least 140 w-hr per pound per cycle, which is considered essential for a practical vehicle with a practical distance range. (APTIC Abs.)

79
Evans, G. E.
HYDROGEN-AIR FUEL CELLS FOR VEHICLE PROPULSION. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 313-323. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

In comparison with the internal-combustion powered vehicle, the hybrid hydrogen-air vehicle will produce no air pollution, will operate silently, will operate at a comparable fuel cost, and will provide similar acceleration, speed, and range. In comparison, with the rechargeable-battery-powered vehicle, the hybrid hydrogen-air-vehicle will provide greater range (as a result of higher energy density) and will permit instant "recharge" by filling the fuel tank. This ability to refuel quickly is a very important advantage. The vehicle discussed in this paper requires 140 kw-hr of stored energy to achieve the desired range. If, as it has been suggested, the battery-powered vehicle is to be recharged in 15-30 minutes while parked, this would call for a 280- to 560-kw, d-c charging station; definitely not a job for an extension cord. Consideration of charging problems again suggests that the hybrid vehicle may offer competitive advantages in heavy-duty vehicles with high energy storage requirements, such as buses and trucks whereas the battery-powered vehicle may be more competitive in lightweight personal cars. In comparison with the vehicle powered by the "pure" fuel cell the hybrid system offers lower weight, lower cost, an energy reserve in case the vehicle runs out of fuel, and a means of utilizing hydrogen boil-off in a safe and effective manner. (APTIC Abs.)

80
Ferrell, D. T., Jr. and A. J. Salkind
BATTERY-POWERED ELECTRIC VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 61-69. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

The economy of three types of electric vehicles is summarized. A plot of range versus the ratio of available power to total vehicle weight shows the effect of weight and acceleration losses on the range of vehicles at a speed of 30 mph. Other charts at other speeds show that at a ratio of 4 w-hr/lb, with a vehicle traveling at 15 mph, the range without stops would be 60 miles; a 30 mph, 50 miles; and at 45 mph, 42 miles. The range is reduced as the number of stops increases. The ratio of 4 w-hr/lb of total vehicle weight is approximately the ratio for existing vehicles. With present technology, the speed and range of electric vehicles are limited by the energy available in the power source. With the power sources now available on a production basis, economics limit the choice to the lead-acid battery system with the limitations of speed and range indicated. (APTIC Abs.)

81
Fracchia, M. F., F. J. Schuette, and P. K. Mueller.
A METHOD FOR SAMPLING AND DETERMINATION OF ORGANIC CARBONYL COMPOUNDS IN AUTOMOBILE EXHAUST. Environ. Sci. & Technol., v. 1: 915-922, 1967.

An automobile exhaust was sampled at 1 l/min of exhaust through a water trap and 2 bubblers in series. The bubblers contained aqueous acidified 2,4-dinitrophenylhydrazine. The carbonyl compounds in the water trap were precipitated with the hydrazine reagent. The hydrazones in the trap and in the bubblers were collected by filtration and extraction, dissolved in CS_2, and analyzed by gas chromatography by using a flame ionization detector. The water trap contained mostly HCHO. All aldehydes were quantitatively trapped in the 1st bubbler, and the ketones were determined from the hydrazones in the 2nd bubbler. The role of potential interferences was evaluated. Sampling efficiencies and analytical errors were established for several compounds. Alkyl and aromatic carbonyl compounds obtained from selected automobiles under several operating modes are compared. More sensitive methods are needed for analyzing carbonyl compounds in all, but a methodology is now available for studying combustion sources. (Chem. Abs.)

82
Frey, J. W. and M. Corn.
PHYSICAL AND CHEMICAL CHARACTERISTICS OF PARTICULATES IN A DIESEL EXHAUST. Amer. Indus. Hyg. Assoc. Jour., v. 28: 468-478, Sept.-Oct. 1967. (Presented at: Aerosol Technol. Session, Amer. Indus. Hyg. Assoc. Annual Meeting, Chicago, Ill., May 4, 1967).

The particulate phase of emissions from a single cylinder, four cycle diesel engine, was sampled four inches from the exhaust valve by a variety of methods, including oscillating thermal precipitator and membrane filter. The engine was operated and studied at three conditions: idle speed, no load, moderate temperature; intermediate speed, no load, high temperature; and half load, resultant speed and temperature. The particulates were studied to determine their particle size distribution, specific surface, chemical composition, and acidity. Results are expressed in terms of emission per cubic centimeter of fuel and per cubic meter of exhaust. Representative results are particles in the size range 10 to 500 microns projected area diameter and emission concentrations of 50 mg/m^3, 10^7 particles/cm^3, and 2 square meters of particle surface area per cubic meter of exhaust. Experimental methods and results are discussed in detail. (Authors' Abs.)

83
Frysinger, G. R.

FUEL CELL—BATTERY POWER SOURCES FOR ELECTRIC CARS. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 83-90. (PHS Publ. No. 99-AP-37) (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Through the use of a fuel cell and battery hybrid power source, all of the so-called vehicle "battery" problems can be overcome. This power source allows an electric vehicle to have: (1) full-range capability; (2) excellent acceleration characteristics; and (3) very fast energy refuel. Achieving the performance outlined for the vehicle requires the successful development of a 150-w-hr/lb molten electrolyte battery and a 20- to 35-lb/kw hydrocarbon fuel cell. Research progress indicates that these goals should be achieved in operational hardware within the next 5-10 years. (APTIC Abs.)

84
Gillis, E. A.

POWER SYSTEMS FOR ELECTRIC VEHICLES FOR MILITARY AND COMMERCIAL USE. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 71-82. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Systems analyses are presented for (1) fuel cells and (2) fuel cell-battery hybrids. Battery and fuel cell hybrid power plants do not offer appreciable savings in weight over fuel cell power plants for use in military vehicles. All-fuel-cell power plants offer the advantages of much lower fuel consumption, and more important, continuous peak power capability. Conversely, fuel cell and battery hybrid systems do offer the potential of a lightweight power plant for electrically powered commercial vehicles. For the military vehicle that may require extended periods of operation at high power levels and where noise or air pollution are not handicaps, hybrid systems utilizing engines as well as electrochemical power plants may be more suitable. (APTIC Abs.)

85
Gregor, H. P.
SEPARATOR SYSTEMS. In: Power Systems for Electric Vehicles. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 173-193. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Recent advances in the physics, chemistry, and technology of battery systems that may be applied to advantage in the fabrication of new and superior battery separators are described. Different battery systems require rather different kinds of separator systems. The separator must, of course, allow for the passage of the ions that carry the current and, in some cases, they also must permit the ready flow of solvent. In other systems, it is desirable to inhibit or even prevent solvent flow. In some systems certain ionic or molecular species should be prevented from moving across the separator to the opposite electrode. In most batteries the separators must prevent the movement of particulate matter away from the plates and retard, if not inhibit, dendritic growth, particularly from one plate toward the other. Various materials and systems are described as examples of their class. Battery scientists and engineers have been much too dependent on commercial films prepared for other purposes for separator material, such as packaging and water treatment. The amount of material needed for membranes usually is so small that manufacturers and fabricators of plastics have not been encouraged toward research and development. Further, research has tended to concentrate separately upon separator materials or upon electrodes and their interaction with electrolytic solutions, but not upon the combined system. A fundamental investigation of electrode reactions in the presence of well characterized separator materials should lead to systems of far reaching practical importance. The development of several new and vastly improved separator systems based on the new materials and technology available today may be anticipated. The complexity of battery systems, particularly for electric vehicles, requires an interdisciplinary approach, with close collaboration on the part of those who synthesize polymers, prepare them in membrane form, study their structure, and finally incorporate them into practical battery systems. (APTIC Abs.)

86
Heath, C. E., E. H. Okrent, M. Beltzer, and others.
DIRECT HYDROCARBON AND METHANAL-AIR FUEL CELLS. In: Power Systems for Electric Vehicles. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 307-312. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Research on direct liquid hydrocarbon and methanol-air fuel cells has identified some of the problems that must be solved before fuel cells can meet the specific requirements for an automotive power plant. The question of whether the fuel cell can reduce air pollution cannot be conclusively answered yet. Direct hydrocarbon cells, operating at temperatures below 500° F, appear to offer no serious source of contamination. Studies have shown that hydrocarbons are completely consumed to carbon dioxide and water in sulfuric acid electrolytes at 90°C. Fuel cell fuels will probably be sulfur and lead-free. Furthermore, the low temperatures should minimize nitrogen oxide formation. Hydrocarbon losses from manifolds and tanks may cause a problem, but using low vapor pressure fuels and proper engineering should minimize this contribution. No major obstacles to a low-emission vehicle are known, but clearly much more experience will be required to define pollution levels in operative systems. The present state of hydrocarbon fuel cell technology cannot meet the requirements of a high-output, low-cost system suitable for extensive vehicular application. Much progress has been made during the past five years. If this progress continues and suitable catalysts are developed, a fuel-cell-powered vehicle could become practical. However, much more research and development will be needed before this stage is reached. (APTIC Abs.)

87
Heredy, L. A., H. L. Recht, and D. E. McKenzie.
THE ATOMICS INTERNATIONAL SODIUM-AIR CELL. In: Power Systems for Electric Vehicles. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 245-253. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

The general criteria used in the engineering studies that led to the selection of the sodium-air system for experimental development are summarized. This is followed by a description of the sodium-air cell, a review of the experimental results, and a discussion of the potential performance of the system. A novel compact sodium-sodium amalgam-air dual cell has been designed and operated. Cell components and complete cells of 0.3- to 2.0-w output have been tested successfully at about 130°C operating temperature. Experimental data and preliminary engineering studies indicate that very high energy and power densities could be achieved with a fully developed sodium-air battery system. High expected performance and the advantages of relatively low operating temperature make this system very attractive for development as a power source for electric automobiles. (APTIC Abs.)

88
Hoffman, G. A.
HYBRID POWER SYSTEMS FOR VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 27-42. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Hybrid power systems for passenger cars, buses, and trucks are discussed. The hybrid system consists of an internal combustion engine (of rating much reduced from the conventional motor that it supplants) driving, at its optimal speed, a generator. The generated electric power goes to the traction motors (integral with all the wheels) and to a sizable secondary battery, also connected with the four electric motors. The advantages of the hybrid system in terms of performance, economy, volumetrics, planning, and environment are as follows: (1) the hybrid's exhaust would be proportionately less polluting than its conventional counterpart; (2) the fuel costs of hybrids might well be one-half to two-thirds of those of gasoline for conventional engines for equal automotive missions; (3) maintenance costs of hybrids also may be perceptibly lower; and lastly, hybridizing the power systems of the automobile, the truck, and the bus would allow breathing time for the more orderly research and development of individual travel means. (APTIC Abs.)

89
Lozano, E. R., W. W. Melvin, Jr., and S. Hochheiser.
AIR POLLUTION EMISSIONS FROM JET ENGINES. Jour. Air Poll. Control Assoc., v. 18: 392-394, June 1968.

Pollution emissions from three representative types of jet engines were determined. Pollutants measured included nitrogen oxides, aldehydes, carbon monoxide, hydrocarbons, and odors. A method is presented for determining the magnitude of pollution emissions due to commercial jet aircraft operation by using basic emission factors. (Authors' Abs.)

90
McMichael, W. F., and J. E. Sigsby, Jr.
AUTOMOTIVE EMISSIONS AFTER HOT AND COLD STARTS IN SUMMER AND WINTER. Jour. Air Poll. Control Assoc., v. 16: 474-477, 1966.

Randomly selected passenger automobiles were driven over a 7.5-mile composite route in Cincinnati, Ohio. Samples of the exhaust gases were collected from each car by means of a proportional sampler and analyzed for gross hydrocarbons, carbon monoxide, carbon dioxide, and oxides of nitrogen. In addition, detailed analysis of the hydrocarbons was made. This included paraffins, 1 through 8 carbon, olefins, 2 through 6 carbon, and aromatics 6 through 10 carbon. This paper compares the differences in these emissions immediately after starting with "cold" engines as opposed to emissions from cars started with engines already warmed up or "hot". This determination was made under both cold and warm weather conditions. A comparison is also made in air pollutants emitted from cars driven under the summer as opposed to the winter conditions normally encountered in Cincinnati, Ohio. (Authors' Abs.)

91
Middleton, J. T. and W. Ott.
AIR POLLUTION AND TRANSPORTATION. Traffic Quart., v. 22: 175-189, Apr. 1968.

The automobile today is the most serious single cause of air pollution. It affects those who drive, walk or work in or near vehicular traffic and contributes significantly to pollution levels over the entire urban area. Federal standards effective in 1968 will reduce the emissions of the two principal pollutants from new automobiles and light trucks. Further restrictions are proposed for 1970 that also limit other classes of vehicles. A gradual reduction in vehicular pollution levels will take place as old vehicles are replaced with new ones. A physical limit exists beyond which further reductions are impossible and other alternatives must be considered. Further study is needed on steam or electrical powered vehicles. Major changes in the planning of our cities including utilization of mass transit and substitutes for the automobiles as a mode of transportation must be considered. There is the added advantage of safer transportation in a cleaner more comfortable and generally more attractive urban environment. Such steps may become necessary as air pollution becomes less of a nuisance and more a question of survival in urban areas.

92
Osthoff, R. C.
POTENTIAL BATTERY SYSTEMS IN VEHICLE PROPULSION. In: Power Systems for Electric Vehicles. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 51-60. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

A computer program was established with which the properties of electric vehicles can be estimated. Preliminary studies based on zinc-air battery systems have been made in which the vehicle range for any mission can be calculated. The utility of hybrid battery systems or battery and fuel cell systems is shown. (APTIC Abs.)

93
Ott, W., J. F. Clarke, and G. Ozolins.
CALCULATING FUTURE CARBON MONOXIDE EMISSIONS AND CONCENTRATIONS FROM URBAN TRAFFIC DATA. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution. June 1967. 44p. (PHS Publ. No. 999-AP-41).

An urban area approach was applied in Washington, D. C., to calculate present and future emissions and ambient concentrations of carbon monoxide. Calculations were based on 1964 and projected 1985 traffic volumes, emission factors, and a meteorological diffusion model. The following findings were obtained: (1) With no emission control, the total carbon monoxide emitted in Washington will approximately double in a non-uniform manner; the smallest increases will occur downtown and the greatest increase at the outskirts. (2) The principal effect of such nonuniformity, also apparent in Chicago, is to increase the area of the city exposed to high emission densities, leading to consequent increases in the area over which concentrations occur. (3) The change in concentrations experienced at one site is influenced more by the emission pattern of the entire urban area than by changes in the immediate vicinity of the site. (4) Without control, the mean annual concentrations at four varied sites in Washington would range from 2.2 ppm to 11 ppm in 1985, representing increases from 44 percent to 69 percent over 1964 values. (5) With 50 percent control, the 1985 concentration at the CAMP station will be 15 percent less than the 1964 value, and values at the other sites will drop from 21 percent to 29 percent. (6) Concentrations calculated for the weekday peak-traffic period (6 to 8 AM) show two-hour average concentrations in 1985 ranging from 1.6 ppm to 25 ppm for various meteorological conditions, representing increases from 40 percent to 120 percent over the 1964 values. (7) Even with 50 percent control, some peak-traffic-period concentrations will increase 10 percent for certain meteorological conditions. (Authors' Abs.)

94
Palmer, N. I.
ZINC-AIR BATTERIES FOR THE ELECTRIC VEHICLE. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 231-244. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967)

A new type of power source— the zinc-air battery, which promises to meet both the rate and capacity requirements of the electric vehicle, is reviewed. The zinc-air battery can be regarded as a hybrid fuel cell and storage battery in that half of the over-all electrochemical couple, the zinc, is stored within the battery, while the other half, oxygen, is taken from the surrounding air and electrocatalytically reduced at a nonconsumable electrode. Secondary zinc-air batteries, design of batteries for the electric car, battery specifications, and alternative operating modes are considered. (APTIC Abs.)

95
Petrova, A., Y. Dalakmanski, and D. Bakalov.
STUDY OF CONTAMINATION OF THE ATMOSPHERE BY INJURIOUS ROAD: TRANSPORT AND INDUSTRIAL PRODUCTS. Journal of Hygiene, Epidemiology, Microbiology, and Immunology (Praha), v. 10: 383-391, 1966.

The first determination of atmospheric lead in Bulgaria, in the air of a big city (Sofia) was carried out in association with the growth of industry and the increase in road transport, in which ethylated petrol has come into use in recent years. Air samples were collected in 20 centers in Sofia and in 3 control centers. The samples were collected in different parts of the city so as to obtain a complete survey. The majority were collected in the center where the traffic is heaviest. Two centers were near factories and 2 were near parks. Lead was found in the city atmosphere in relatively high concentrations (mean concentration 4.25 ± 0.27 $\mu g/m^3$.) It was also found in the suburbs, though in lower concentrations. This lead comes from factories and road transport. The carbon monoxide concentration in the air of Sofia was studied by the same method as for lead. Carbon monoxide was found to be distributed all over the city, the mean concentration being 10.88 ± 3.01 mg/m^3. This is higher than the norm and is also 5 times higher than the concentration found 6 years previously. The effect of these harmful substances (in particular lead) in the air of Sofia was determined by studying the urine coproprophyrin level in children aged 5-7 attending city kindergartens. The findings were compared with the results of analysis of the urine of children of the same age attending kindergartens in various Sofia suburbs. Coproprophyrinuria was found more frequently and its level was higher in city children. (Authors' Abs.)

96
Ragone, D. V.
AN ELECTRICALLY RECHARGEABLE ZINC-AIR BATTERY FOR MOTIVE POWER. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 225-229. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

The considerations of the use of low-cost materials, relatively low-temperature operation, and freedom from potential operational hazards for the user led to the selection of the zinc-oxygen (air) couple, operating with an aqueous electrolyte at temperatures below the boiling point of water. Some of the important features of the battery are as follows: (1) a solid zinc "frontal surface" electrode is used with the zinc plated on an inert substrate so that substantially all of it can be used during discharge; (2) the electrolyte, an aqueous solution of potassium hydroxide, circulates. This allows the reaction product to be swept from the cell and stored externally; and (3) atmospheric oxygen is introduced as a reactant through a porous nickel "bubbling" electrode. The operation of the battery, and the history of the program are considered. The program is directed at the design, building, and testing of a battery for a delivery van. Capacity will be between 50 and 100 kwhr. The prototype is scheduled to be ready for bench testing in early 1968 and for preliminary vehicle tests toward the end of 1968. (APTIC Abs.)

97
Ramsey, J. M.
CARBON MONOXIDE EXPOSURES IN PARKING GARAGES. Bull. Environ. Contam. Toxicol., v. 2: 182-190, 1967.

Hourly air sampling at 7 enclosed type parking garages for 25 days indicated a mean CO concentration of 58.1 ppm. Exposure for 8 hours each day poses a potential occupational hazard to those already having some degree of impairment of tissue oxygenation. (Chem. Abs.)

98
Shair, R. C., A. E. Lyall, and H. N. Seiger
LITHIUM NICKEL-HALIDE BATTERIES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 289-295. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Efforts to develop a battery using lithium as the anode and nickel halide as the cathode are reported. The feasibility of the lithium-nickel halide battery has been demonstrated. At the C/5 rate of discharge, which has been realized, the battery can provide power for cruising of a vehicle and its energy density of 100 w-h/lb provides an attractive mileage range. Its present limitation is its power density of 50 lb/k, which requires too large a battery to provide acceleration peaks. Bipolar nickel-cadmium batteries have been developed in our laboratories. Because of their unique geometry and construction, these batteries have a weight to power ratio of 3 lb/k for short periods of time—of the order of minutes. A small bipolar nickel-cadmium booster battery coupled in parallel with the lithium battery can provide the necessary peak power. It can be small compared to the lithium battery, since the duration of acceleration peak loads is short, and during cruising, the bipolar battery can be recharged in minutes from the main battery. Bipolar nickel-cadmium battery technology is well-advanced. A vehicle weighing about 3000 lb requires about 5 hp to cruise on level road at 30 mph. For grades and acceleration peaks, it would require up to 15 horsepower. For cruising at 5 k a lithium battery with a weight-to-power capability of 50 lb/kw would have to weigh at least 250 lb. At 100 w-hr/lb, it would be capable of 5 hr of operation, which at 30 mph is 150 miles. To provide the 15-kw peaks would require about 45 lb of bipolar nickel-cadmium battery at 3 lb/k. Since 5 kw would still be coming from the lithium battery, 45 lb allows some margin of safety and the peak would be available for several minutes if necessary. The nonaqueous lithium-nickel halide battery coupled with a bipolar nickel-cadmium booster has attractive features for vehicular propulsion. (APTIC Abs.)

99
Stern, A. C.
CONTRIBUTION OF VEHICULAR EXHAUST TO AIR POLLUTION. In: Biochemical and Human Factors Symposium, Washington, D. C., Apr. 3-5, 1967. New York, ASME, 1967, p. 150-161.

The amount of CO, hydrocarbons, and nitrogen oxides contributed by cars is discussed, along with the effect of weather on the pollution. Means of reducing pollution by car exhaust are listed. (Biol. Abs.)

100
Vansant, C. A.

THE MECHANICAL DESIGN OF ELECTRIC AUTOMOBILES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 143-154. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Mechanical design factors are taken into account since they have quite a significant part in the decision whether or not to design and build electric cars at all. Images are constructed of clearly desirable and useful automotive transportation systems that are consistent with technological capabilities and economic realities. The factors which affect vehicle energy requirements are considered. Although a number of engineering alternatives for electric vehicle design are well known and are found throughout the spectrum of modern technology, electric cars are really favored only by entirely new designs—designs that are inherently suited to electric propulsion. In addition, the electric car should be viewed as an evolving vehicle. It has been proposed as a solution to air pollution problems, but is should not be expected to appear, miraculously, as a panacea. (APTIC Abs.)

101
Wilcox, H. A.

ELECTRIC VEHICLE RESEARCH. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 91-104. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Research and development work on high-performance energy conversion systems based on the lithium-chlorine couple is reviewed. The silver-zinc battery-powered research car called Electrovair II, and the hydrogen-oxygen fuel cell powered experimental vehicle called Electrovan are briefly discussed. Potential advantages of electric vehicles include quiet operation, efficiency not limited by heat engine cycle, reduction of emissions and use of low-cost electricity generated by nuclear reactors when fossil fuels become more scarce. Research on electric vehicles offers potential for commercial payoff in many other fields. Any power system considered in the whole, presents possible pollution problems. It is still too early to state definitely that any kind of electric automobile will soon be able to win an economically significant and viable place for itself in the total transportation picture. (APTIC Abs.)

102
Wouk, V.
ELECTRONIC CIRCUITS FOR SPEED CONTROL AND BRAKING. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 123-142. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967).

Modern high-power semiconductors in comparatively simple circuits, controlling power from batteries that are capable of being recharged rapidly, make a battery-powered bus technologically practical for some urban applications. Regenerative braking can substantially extend the range between charges in stop-and-go traffic, besides a necessity for safety. Some basic concepts of electronic circuitry incorporate "off-the-shell" high-power semiconductors and 100-amp-hr cells that can be charged at rates up to 1,000 amp, for an operational bus. In a battery-powered vehicle, electronic circuits can perform the functions of electric motor control for maximum utilization of battery power and can provide performance similar to that of conventional fuel engines. In addition, electronic controls can allow regenerative braking, which will provide performance similar in most respects to conventional braking on conventional automobiles. The circuits that will obviously work at present, even in quantities of thousands, will be substantially more expensive than the simple mechanical controls for a conventional automobile. However, if the lower prices of low-power semiconductors are applied, the outlook is much more attractive. In an application such as a bus, where the complete elimination of the contribution to air pollution is invaluable to the community, the added initial cost of the battery-powered bus is negligible. The possibility of polluting the air with ozone is purely academic when semiconductors are used. Some people have also shown concern about the strain on the electric-power-generating capacity of the United States if battery-powered vehicles were used widely. This concern is completely unnecessary, because if all internal combustion engines were converted to battery-powered vehicles overnight, the load requirements on the electric utilities would be approximately doubled. Calculations of power-generation are also given. All facets of the air pollution problem point to the great desirability of putting into operation at once, with today's technology, a battery-powered bus. When tomorrow's technology eliminates the problems of range, speed, and initial cost of battery-powered buses, we will all be able to enjoy the benefits of this pollution-free type of transportation. (APTIC Abs.)

103
Zaromb, S.
ALUMINUM FUEL CELL FOR ELECTRIC VEHICLES. In: Power Systems for Electric Vehicles. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, p. 255-267. (PHS Publ. No. 999-AP-37). (Presented at: Symposium on Power Systems for Electric Vehicles, New York, Apr. 6-8, 1967)

Although aluminum has long been recognized as a potentially superior battery anode material, its practical use has been precluded by excessive passivity in most electrolytes or by excessive corrosion in nonpassivity electrolytes. The corrosion of aluminum in alkaline solutions has now been successfully inhibited reproducibly and over long periods of time, while operating an experimental 60- to 80-w aluminum-air battery at a current density of 40-50 amp/sq ft and 1.1 to 1.3 v/cell. These experiments have generally confirmed the expected high energy capacity of alkaline aluminum-air batteries. The chemical rechargeability (by anode and electrolyte replacement) of our aluminum-air battery should constitute an important advantage. Other advantages, such as a 1,000-mile driving range between electrode refuelings, exceptional safety, functional superiority and over-all economy should allow aluminum-driven automobiles to greatly surpass present cars. (Author's Abs., Modified)

III. ATMOSPHERIC INTERACTIONS

104
AIRBORNE MICROBES. SEVENTEENTH SYMPOSIUM OF THE SOCIETY FOR GENERAL MICROBIOLOGY. Imperial College, London, Apr. 1967. Ed. by P. H. Gregory and J. L. Monteith. New York, Cambridge University Press. 1967, 397p.

This symposium brought together workers from several fields, ranging from engineering and meteorology to botany and pathology, to discuss both physical and biological aspects of aerobiology. The opening papers consider the processes of diffusion and transport. The next section covers the physical principles of sampling and techniques of handling the catch. Biological papers deal with dispersion, visibility and deposition. Papers on airborne diseases include descriptions of the spread and control of plant pathogens, viruses of the respiratory tract, and bacterial infections. Mycobacterium tuberculosis is examined in detail. The final section concerns the use of aircraft to detect long-distance spore transports by wind and problems of space vehicle decontamination. Papers of biologic interest in this book will be abstracted and will appear in appropriate sections of Biological Abstracts. There is a subject index. (Biol. Abs.)

105
Charlson, R. J.
A SIMPLE NOCTILUCENT CLOUD MODEL. Tellus (Stockholm), v. 18: 451-456, 1966.

Particles of dust (e. g., of cosmic origin) falling through a supersaturated layer near the mesopause will become coated with ice. The thickness of this coating is an important parameter in discussing the optical properties and mass budget of the system. Calculations of this thickness are presented, including the dependence on the vertical extent of the layer, the humidity, the vertical wind velocity, and the density of the dust particles. The results of these calculations indicate the range of conditions that might be sufficient to produce a noctilucent cloud. The effects of sedimentation on the mass budget are considered with the conclusion that an updraft of tens of cm/sec is necessary for a steady-state condition. (Chem. Abs.)

106
Felmeister, A., M. Amanat, and N. D. Weiner.
INTERACTION OF NITROGEN DIOXIDE-OLEFIN GAS MIXTURES WITH LECITHIN MONOMOLECULAR FILMS. Environ. Sci. & Technol., v. 2: 40-43, Jan. 1968.

The interaction of nitrogen dioxide-olefin gas atmospheres with saturated and unsaturated lecithin monomolecular films were investigated using surface pressure measurements. Films of dipalmitoyl lecithin, a saturated phospholipide, showed no interaction with any of the test atmospheres used. Films of egg lecithin, an unsaturated phospholipide, showed significant changes in the surface pressure-surface area curves in the presence of all atmospheres containing nitrogen dioxide. The observed effects appear to be the result of a chemical interaction of NO_2 with the double bonds of the egg lecithin rather than a simple physical penetration of the film. Biological implications are discussed. (Authors' Abs.)

107
Gregory, P. H.
ATMOSPHERIC MICROBIAL CLOUD SYSTEMS. Science Progress (London), v. 55: 613-628, 1967.

Air-borne microbial clouds consisting of mixed suspensions of protozoa, bacteria, spores of cryptograms and pollen of flowering plants, form a normal component of the atmosphere indoors and out. Knowledge of the microbial cloud system depends on efficient sampling methods for removing the relevant particles from a measured volume of air. Sampling studies show that the composition of the microbial aerosol changes according to place, season, time of day, weather and human activity. These changes reflect factors determining input of microbial particles into the cloud, transport by wind, mixing by eddies and loss by deposition and death. Sampling from aircraft flying through the microbial cloud produced from England indicated the existence of discrete spore clouds over the North Sea corresponding to organisms liberated during the previous day and the 2 previous nights. Concentrations fluctuate over a vast range, and the information is inadequate to define norms for the microbial cloud. (Author's Abs.)

108
Haagen-Smit, A. J. and L. G. Wayne.
ATMOSPHERIC REACTIONS AND SCAVENGING PROCESSES.
In: Air Pollution, v. I: Air Pollution and Its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 149-186.

The principles of atmospheric reactions including: (1) primary and derived air pollutants, (2) atmospheric assimilation and removal of pollutants, (3) formation of intermediate reaction products, (4) photochemical and photosensitized reactions, (5) heterogeneous reactions, and (6) prediction of atmospheric concentrations are discussed. The reactions occurring in the atmosphere concerning sulfur oxides, nitrogen oxides, organic materials, and/or photochemical smog are presented. Deposition and conversion to normal atmospheric constituents are two routes available for scavenging of foreign material from the atmosphere. Any pollutants not eliminated by one of these methods accumulates in the atmosphere. Both processes are facilitated by chemical processes. The particular scavenging processes occurring with sulfur oxides; fluorides, sulfides and ammonia; carbon dioxide and monoxide; nitrogen oxides and photochemical products; and particulate matter are discussed.

109
Hagen, C. A., E. J. Hawrylewicz, and R. Ehrlich.
SURVIVAL OF MICROORGANISMS IN A SIMULATED MARTIAN ENVIRONMENT. II. MOISTURE AND OXYGEN REQUIREMENTS FOR GERMINATION OF BACILLUS CEREUS AND BACILLUS SUBTILIS VAR. NIGER SPORES. Appl. Microbiol., v. 15: 285-291, 1967.

The effects of moisture and oxygen concentration on germination of Bacillus cereus and B. subtilis various niger spores were investigated in a simulated Martian environment. Less moisture was required for germination than for vegetative growth of both organisms. A daily freeze-thaw cycle lowered moisture requirements for spore germination and vegetative growth of both organisms, as compared with a constant 35 C environment. Oxygen had a synergistic effect by lowering the moisture requirements for vegetative growth, and possibly germination, of both organisms. Oxygen was not required for spore germination of either organism, but was required for vegetative growth of B. subtilis and for sporulation of both organisms. (Authors' Abs.)

110

Jaffe, L. S.

AMBIENT CARBON MONOXIDE AND ITS FATE IN THE ATMOSPHERE. Jour. Air Poll. Control Assoc., v. 18: 534-540, Aug. 1968.

Carbon monoxide, the most abundant air pollutant found in the atmosphere generally exceeds that of all other pollutants combined (excluding CO_2). An estimated tonnage of $>87 \times 10^6$ of CO was emitted in the United States from major technological sources alone during 1966. More than 90% of the total CO emitted from fossil fuels is derived from gasoline powered motor vehicles. Other sources of CO include emissions from coal and fuel oil burning, aircraft and open burning. Some CO is also formed by certain vegetation and marine invertebrates (siphonophores). Chemical reactions of CO in the upper and lower atmosphere are discussed. Chemical oxidation of CO in the lower atmosphere by molecular oxygen is very slow. The exact duration of CO in the lower atmosphere is not known with certainty; however, the mean residence time has been variously estimated to be between 0.3 and 5.0 years. In the absence of scavenging processes the estimated world-wide CO emission would be sufficient to raise the atmospheric level by 0.03 ppm per year, yet the background levels of CO in clean air do not appear to be increasing. Several potential sinks are discussed. Knowledge of the mechanism of process of removal of CO from the lower atmosphere is unsatisfactory; the process, at the present time, cannot be identified with certainty. (Author's Abs.)

111

McCormick, R. A. and J. H. Ludwig.

CLIMATE MODIFICATION BY ATMOSPHERIC AEROSOLS. Science, v. 156: 1358-1359, June 9, 1967.

Theoretical considerations and empirical evidence indicate that atmospheric turbidity, a function of aerosol loading, is an important factor in the heat balance of the earth-atmosphere system. Turbidity increase over the past few decades may be primarily responsible for the decrease in the worldwide air temperature since the 1940's. (Authors' Abs.)

112
Orr, C., Jr., J. H. Burson and E. Y. H. Keng.
AEROSOL RESEARCH IN CHEMICAL ENGINEERING AT GEORGIA TECH. Jour. Air Poll. Control Assoc., v. 17: 590-592, Sept. 1967.

Aerosol research at Georgia Tech within the discipline of Chemical Engineering is more concerned with the utilization of gas borne particles than with properties, per se. Current efforts involve heat transfer to clouds of particles, the nucleation of supersaturated droplets, centrifugal classification of particles, the dispersion of particles as clouds, and gas cleaning. (Air Poll. Abs.)

113
Serat, W. F., F. E. Budinger, Jr., and P. K. Mueller.
TOXICITY EVALUATION OF AIR POLLUTANTS BY USE OF OF LUMINESCENT BACTERIA. Atmos. Environ., v. 1: 21-32, 1967.

Cells of a species of luminescent bacteria [Photobacterium phosphoreum] were treated with a gas stream containing products formed by the photochemical oxidation of cis-2-butene and NO. Luminescence and viability decreased with the time of irradiation of reactants. The rate of luminescence decrease was dependent on the ratio of the initial concentrations of cis-2-butene and NO with a ratio of 2 giving the most rapid loss. Known photochemical oxidation products, ozone, NO_2, formaldehyde, acetaldehyde, and PAN were examined individually. Aldehydes did not appear to contribute to the decrease in luminescence but ozone and PAN [peroxyacetylnitrate] did. Although NO_2 alone up to 0.5 ppm produced no decrease, it may contribute to the luminescence loss in the total irradiation mixture. The total oxidant concentration produced upon irradiation gave luminescence decreases which were matched by comparable concentrations of pure ozone. However, this does not imply that luminescence losses caused by photochemical oxidants are due only to ozone. A possible mechanism of the toxic effect and the interpretation of this bioassay in relation to other organisms are briefly discussed. (Authors' Abs.)

114
Sharp, E. L.
ATMOSPHERIC IONS AND GERMINATION OF UNREDOSPORES OF PUCCINIA STRIIFORMIS. Science, v. 156: 1359-1360, 1967.

Atmospheric ions, identified by mobility characteristics, were associated with germination of lyophilized uredospores of Puccinia *striiformis* West. at Bozeman, Montana. Ions of intermediate size were highest in concentration, and percentage germination of spores was lowest during periods conducive to air pollution. In duplicate experiments at an isolated site near Barrow, Alaska, essentially all atmospheric ions were small ions and the fungus spores were consistently germinated near maximum. (Author's Abs.)

115
Terraglio, F. P., and R. M. Manganelli.
THE ABSORPTION OF ATMOSPHERIC SULFUR DIOXIDE BY WATER SOLUTIONS. Jour. Air Poll. Control Assoc., v. 17: 403-406, 1967.

Results of a laboratory study indicate that the rate of solution of atmospheric sulfur dioxide in distilled water, over the range of atmospheric concentrations of 0.81-8.73 mg SO_2/m^3, is a function of the concentration of SO_2 in the atmosphere, with saturation being reached more rapidly at the higher concentrations. This would indicate that rain water, with constantly renewed surfaces, can be very effective in the removal of atmospheric SO_2. The pH of the exposed water samples reached values of 4.0 or less, comparable to values observed in fog and cloud water near large industrial areas. Overall solubility of sulfur dioxide in distilled water did not follow the law of partial pressure. At the atmospheric concentrations used it was found that over 98.5% of the sulfite in solution was in the form of the bisulfite ion. The remainder, present as unionized sulfurous acid in the solution, showed that the solubility of this portion of dissolved sulfite did follow the law of partial pressure. (Authors' Abs.)

116
Terraglio, P. and R. M. Manganelli.
THE INFLUENCE OF MOISTURE ON THE ADSORPTION OF ATMOSPHERIC SULFUR DIOXIDE BY SOIL. Air and Water Poll. Internat. Jour., v. 10: 783-791, 1966.

Dry Nixon soil was found to retain 1134 µg of sulfur dioxide [SO_2] when 600 liters of air containing 6.03 mg SO_2/m^3 was passed through 10 g of the soil. Two per cent soil moisture increased the retention to 1908 µg; 5% to 2888 µg; and 10% to 2909 µg. Dry Lakewood soil was found to retain no SO_2 when 600 liters of air containing 7.27 mg SO_2/m^3 was passed through 25 g of the soil. When 2% moisture was present 285 µg of SO_2 was retained, and this increased to 383 µg at 5% moisture, and to 567 µg with 10% moisture. It has been shown that dry acid soils do not remove SO_2 from the air, but less acid soils can retain significant quantities of the gas. Moisture in soil increases the amount of SO_2 that will be retained by a soil so that all soils can be said to remove SO_2. (Authors' Abs.)

117
Wagman, J.
CURRENT PROBLEMS IN ATMOSPHERIC AEROSOL RESEARCH.
Air and Water Poll. Internat. Jour., v. 10: 777-782, 1966.

Specific problem areas of aerosol research are reviewed and discussed. The problems include the need for extensive and precise data on particle size distribution of significant chemical components and gross particles; development of means for obtaining these data such as a high volume sampler, techniques for size analysis of acid mists, and the use of visibility and optical methods to determine aerosol characteristics in situ; and studies of interactions between gases and aerosols and the effects of such combinations on air pollution. (Chem. Abs.)

118
Wagman, J.
CURRENT RESEARCH ON ATMOSPHERIC SULPHUR COMPOUNDS AND THEIR TRANSFORMATIONS. In: Air Pollution. Proc. Symposium Physico-chemical Transformation of Sulphur Compounds in the Atmosphere and the Formation of Acid Smogs. Paris, OECD. Directorate for Scient. Affairs, Dec. 1967, 15p. (Paper No. 1)

All aspects of the disposition of sulfur compounds in the atmosphere are of great importance in view of the vast quantities of these materials that are being emitted into the air. Previous studies on mechanisms for the oxidation of SO_2 in the atmosphere and of its possible involvement in photochemical reactions with hydrocarbons and oxides of nitrogen lead to the conclusion that oxidation may proceed by several types of reactions with the predominant route governed by the prevailing conditions of concentration, humidity, temperature, presence of other pollutants, incident radiation, terrain, etc. A few of the relevant research projects now underway are selected for discussion. These include (a) a study of the particle-size distribution of suspended sulfate particulates in urban air with an evaluation of the influence of some atmospheric variables, (b) studies of interactions between gases, especially SO_2, and particulates, (c) an investigation to define the reactions that sulfur compounds undergo in stack plumes from coal- and oil-burning power plants, and (d) the development of a metal-film technique for the identification and size analysis of acid aerosol droplets. (APTIC Abs.)

119
Wagman, J., R. E. Lee, Jr., and C. J. Axt.
INFLUENCE OF SOME ATMOSPHERIC VARIABLES ON THE CONCENTRATION AND PARTICLE SIZE DISTRIBUTION OF SULFATE IN URBAN AIR. Atmos. Environ., v. 1: 479-489, July 1967.

Variations in the particle size distribution and concentration of atmospheric sulfate during a week in each of four cities were assessed with regard to the influence of such factors as location, humidity, sulfur dioxide level and time of day. Average sulfate mass median equivalent diameters (MMD) in Cincinnati, Chicago and Fairfax (Ohio) were nearly the same (0.42 μ) despite large differences in sulfate concentration and heterodispersity. A higher MMD (0.66 μ) in downtown Philadelphia was at least partly attributable to the presence of dust generated by road construction near the sampling site. Sulfate MMD generally increased with increasing relative humidity, whereas sulfate concentration was more closely correlated with absolute humidity except when SO_2 levels exceeded 3 pphm. Periodic variations in the sulfate parameters at the different locations were characterized by the lack of a consistent pattern and could not be explained on the basis of humidity changes alone. (Authors' Abs.)

(a) Dispersion

120
Calvert, S.
THE RING AROUND THE AIR BASINS. Jour. Air Poll. Control Assoc., v. 17: 366-367, June 1967.

An air basin is defined as "a self contained air pollution system of source-transport-receptor" or as "one of a set of subsystems which are noninteracting for air pollution". Philosophy is important in leading to a method of mapping pollutant concentration contours out to the air quality standard (AQS); the ring around the air basin. Succinctly, we seek the worst expectable condition and the farthest range of effect. Maps of AQS contours have been prepared by a computer programmed to calculate and print out the data. The means now are available to map the probable extent of air basins. The inaccuracies of the method decrease with increasing distance from the source and time projection into the future. So far the only pollutants we have found which form big basins are SO_2 and suspended particulates. Mapping CO and NO_2 yielded small contour circles, but possibly photochemical smog may have

more range. The fact that the predictions are alarming should not cause us to be timid in making them. They represent a reasonable expectation for the present. What should they look like for 2000 AD? Those responsible for legislation and programs need to see the entire picture and be clearly apprised of the choices they must make. (APTIC Abs.)

121
Calvert, S., J. Davis, D. Lundgren and others.
DEFINITION OF PENNSYLVANIA AIR BASINS (SECOND QUARTERLY PROGRESS REPORT). Pennsylvania State Univ., University Park, Apr. 15, 1967, 39p.

Research during the period January 15, 1967 to April 15, 1967 on the definition of Pennsylvania air basins is reported. A special dispersion model for stagnation periods has been used with source data to predict sulfur dioxide and suspended particulate concentration contours. Large basins on the western and eastern sides of the state are apparent. A more elaborate diffusion model which will be useful with "real time" data is being developed. Exploratory work with the Lundgren large volume air sampler indicates the potentiality of the instrument as well as some necessary modifications in technique. Atomic absorption spectroscopy has been investigated briefly for chromium, manganese, lead, and copper and continues to be promising. Vans for field sampling are being outfitted and are ready for field operations planned for the Altoona area in April - May, 1967. Along with the large volume air sampler, particle analyzers and the G. E. nuclei counter analyzer will be used. Several new particle analysis devices based on light scattering are under development. Spectrographic analysis of collected particulates is being evaluated and remains interesting. (Authors' Abs.)

122
Cole, A. L. and B. Harrington, Jr.
AIR POLLUTION BY RAGWEED POLLEN. III. ATMOSPHERIC DISPERSION OF RAGWEED POLLEN. Jour. Air Poll. Control Assoc., v. 17: 654-656, Oct. 1967.

The study of atmospheric dispersion of ragweed pollen is complicated by its abundance and widespread distribution in the atmosphere. Artificially reared ragweed plants which flower and pollinate some two months in advance of the normal season were used for experiments to determine flotation and transport mechanisms. Atmospheric pollen sampling methods which are discussed include gravity slide, volumetric and impaction samplers. (APTIC Abs.)

123
Conner, W. D.
OPTICAL PROPERTIES AND VISUAL EFFECTS OF SMOKESTACK PLUMES. 1967, 89p. (Public Health Service Publ. No. 999-AP-30).

Two experimental smoke stacks were constructed to provide test plumes for studies of optical properties and visual effects over a wide range of illuminating and viewing conditions. Results indicate that visual effects are not intrinsic properties of the plumes, but vary with the background of the plume and with illuminating and viewing conditions. Variation was much greater with white plumes than with black. The angular scattering and transmission characteristics of the experimental plumes were measured and estimates of particle size derived therefrom. The study shows that the quantity of aerosols in a plume is best evaluated optically by its transmittance. Special methods for measuring the transmittance of smoke plumes objectively are discussed. (APCA Abs.)

124
Davidson, B., J. P. Friend and H. Seitz.
NUMERICAL MODELS OF DIFFUSION AND RAINOUT OF STRATOSPHERIC RADIOACTIVE MATERIALS. Tellus (Stockholm), v. 18: 301-315, 1966.

A numerical model in 2 dimensions capable of simulating diffusion, transport, particle fall velocity, and tropospheric rainout is described. The model incorporates a general anisotropic diffusion process. Rainout is simulated by fractional removal of debris at selected rain "formation" levels; the fraction removed at any latitude is proportional to the observed rainfall at that latitude. In the present paper the transport terms are neglected and an attempt is made to reproduce available data with a diffusion-rainout-settling velocity model. The parameters of the model are varied in an attempt to reproduce quantitatively the known behavior of W^{185} injections in equatorial regions and, at least qualitatively, the behavior of high latitude stratospheric injections. Three types of models are described; they are characterized, respectively, by the principal diffusion axis being (a) along a horizontal surface, (b) along surfaces of constant potential temperature, and (c) along surfaces of constant potential vorticity. All 3 types can reproduce the latitudinal variation of rainout in a satisfactory manner, but only the 3rd can reproduce the observed pattern of concentration in the stratosphere. The 3rd type yields satisfactory results by using lines of constant potential vorticity (only tentatively established by Hering and Borden) or using lines parallel to the tropopause as the principal axis of diffusion. (Chem. Abs.)

125
Hewson, E. W. and L. E. Olsson.
LAKE EFFECTS ON AIR POLLUTION DISPERSION. Jour. Air Poll. Control Assoc., v. 17: 757-761, Nov. 1967.

Local wind regimes induced by a lake or a shoreline may have a major influence on air pollution dispersion. Pressure differences due to differential heating of the air, e.g., that due to differences in surface characteristics, are the driving forces of lake and land breeze circulations and slope and valley winds. Differences in roughness between land and lake surfaces will cause wind shear and aerodynamic downwash effects at a shoreline. Stability changes in the air result from differences in surface temperature and roughness between land and lake, e.g., when warm unstable air moves out over a cool lake a temperature inversion will develop near the surface giving very poor dispersion conditions in this lower layer. Pollution released in this stable layer may be carried in high concentrations for many miles and cause severe damage as the air moves across a downwind shoreline and advances inland. The information presented is designed to permit an assessment of the probably complexity of the dispersion patterns near a shoreline so that possible requirements for additional meteorological and dispersion information may be determined. Brief descriptions of two actual lakeside sites, one on Lake Erie and the other on Lake Michigan, are given and their relevant characteristics are presented. Natural ventilation was above average at both sites. (Authors' Abs.)

126
Jarman, R. T. and C. M. De Turville.
THE SCREENING POWER OF VISIBLE SMOKE. Air and Water Poll. Intern. Jour., v. 10: 465-467, 1966.

An expression for the contrast between a smoke plume and its background is derived from well-known principles. This expression explains the variation of the appearance of a smoke plume under different atmospheric conditions. The relation between the screening power of smoke and its visibility is then derived and compared with recent measurements by Crider and Tash. (Authors' Abs.)

127
Koogler, J. B., R. S. Sholtes, A. L. Danis and others.
MULTIVARIABLE MODEL FOR ATMOSPHERIC DISPERSION PREDICTIONS. Jour. Air Poll. Control Assoc., v. 17: 211-214, Apr. 1967.

A mathematical model was developed in conjunction with a 15-month air quality survey of Jacksonville, Fla. The major sources were considered separately from one-mile square area sources which accounted for the remainder of emissions. The meteorological data in the city, including vertical temperature observations to 750 ft were recorded continuously. A model was compiled in FORTRAN and can be used for both gaseous and particulate pollutants, by utilizing proper decay rates. The ground level concentrations of several pollutants, which were determined for 24 hour periods at 11 sites and continuously at two other sites, were used to check the model. (Eng. Index)

128

Meland, B. R.
A COMPARATIVE STUDY OF PARTICULATE LOADINGS IN PLUMES USING MULTIPLE SAMPLING DEVICES. Jour. Air Poll. Control Assoc., v. 18: 529-533, Aug. 1968.

Particle size distributions, particulate concentrations, and particle identities must be known to relate effluents to reduction in visibility and soiling. Similar types of emissions were measured with cascade impactor, membrane filter, and rotorod samplers. The different particle size distributions, concentrations, and identifications are reported. Discussion of and recommendations for utilization of these three methods of sampling are made. (Author's Abs.)

129

Miller, M. E. and G. C. Holzworth.
AN ATMOSPHERIC DIFFUSION MODEL FOR METROPOLITAN AREAS. Jour. Air Poll. Control Assoc., v. 17: 46-50, 1967.

An urban diffusion model, which does not require the use of an electronic computer, is presented. The main simplifying assumptions are that continuous pollutant sources are uniformly distributed over the urban area and vertical diffusion occurs until the effluent from each line source reaches the top of the mixing layer, after which the effluent is uniformly distributed through the mixing layer. After the appropriate vertical diffusion coefficient is specified, the calculated concentration is a function of source strength, linear dimension of the metropolis, mixing depth, and wind speed. The calculated concentration is interpreted either as a representative maximum concentration or, through integration, as the average concentration over the metropolitan area. When a representative pollutant concentration is known, the model may be used to determine the apparent "uniform" source strength. (Authors' Abs.)

130
Montgomery, T. L. and M. Corn.
ADHERENCE OF SULFUR DIOXIDE CONCENTRATIONS IN THE VICINITY OF A STEAM PLANT TO PLUME DISPERSION MODELS. Jour. Air Poll. Control Assoc., v. 17: 512-517, Aug. 1967.

Air monitoring data for a calendar year at one of the TVA power plants has been used to evaluate the appropriateness of the Sutton, the Bosanquet and Pearson, and the USPHS-TVA atmospheric dispersion models to predict ground level concentrations of sulfur dioxide from emission and meteorological data. Aerometric data included one half hourly average sulfur dioxide concentrations, recorded by four Thomas autometers, and the necessary meteorological parameters for the solving of atmospheric dispersion models. Based on these meteorological parameters and observed plume rise data, over four thousand one half hourly average maximum and minimum expected ground line sulfur dioxide concentrations were predicted for each of the above dispersion models by the use of computer techniques. The plant is a line source; however, an empirical correction was applied to emission data to reduce them to emissions for an equivalent point source. The predicted sulfur dioxide levels for each of the dispersion models were compared to the measured levels throughout the year. Three different sets of diffusion coefficients were applied to the Sutton model and successful predictions, according to a criterion utilizing an acceptable range of concentrations, varied from 66 to 93%. The Bosanquet and Pearson model produced successful predictions 90% of the time, while the USPHS-TVA model was successful 94% of the time. Unsuccessful predictions were primarily overestimates. (Authors' Abs.)

131
Niemeyer, L. E. and R. A. McCormick.
SOME RESULTS OF MULTIPLE-TRACER DIFFUSION EXPERIMENTS AT CINCINNATI. Jour. Air Poll. Control Assoc., v. 18: 402-405, June 1968.

A number of diffusion experiments during near-neutral stability conditions are described which utilize the simultaneous dissemination of up to three gaseous and one particulate tracer material. The magnitude and sources of "non-meteorological" errors are analyzed with respect to a single experiment using but one tracer. The relation of observed ground-level concentrations out to distances of the order 115 km from the source to those estimated by the extrapolation of shorter-range experimental results is also discussed. (Authors' Abs.)

132
Pooler, F., Jr.
A TRACER STUDY OF DISPERSION OVER A CITY. Jour. Air Poll. Control Assoc., v. 16: 677-681, 1966.

The planning and conduct of series of tracer experiments carried out in St. Louis in the period between 1963 and 1965 is described. Tentative results indicate that horizontal dispersion over an urban area does not differ greatly from that observed over open country, except for a much greater initial spreading of the tracer plume. Vertical dispersion during the daytime does not appear to differ greatly from that observed over open country, and can be best expressed in terms of travel time rather than travel distance. Vertical dispersion during the evening over an urban area is much greater than that observed over open country; the limited results obtained suggest the formation of a slightly unstable layer as the air flows over the city. (Author's Abs.)

133
Raynor, G. S.
EFFECTS OF A FOREST ON PARTICULATE DISPERSION. 1967, 20p. incl. diagrs. (Presented at: USAEC Meteorological Information Meeting, Atomic Energy of Canada, Ltd., Chalk River, Ontario, Sept. 12-14, 1967).

Dispersion of particulate clouds approaching and penetrating a forest edge was studied using a permanently instrumented sampling network. Over one hundred rotoslide samplers were located at five heights within and above the trees from the upwind edge to 100 meters inside the forest. An extensive array of sensitive anemometers, two temperature profile measuring stations and sensitive bivanes documented conditions during dispersion experiments and provided data for a comprehensive study of air flow within and around the forest. Unique data were obtained by the simultaneous release of differently colored but physically identical pollens from three points spaced vertically or horizontally. Area sources consisted of pollen released naturally from plots of cultivated ragweed. Results are compared to those obtained from similar experiments over open terrain and to values calculated using a statistical dispersion model. Four principal effects attributed to the forest are observed: (1) The plume is broadened both vertically and horizontally by divergence of the wind at the forest edge; (2) Particles tend to penetrate at tree trunk height or to rise above the forest since the canopy foliage is denser than that at low levels; (3) Loss of particulates occurs mainly in two stages and by two mechanisms, impaction near the forest edge and deposition well within the forest; (4) Loss over the distance studied is considerably greater than over open terrain. (APTIC Abs.)

134
Stewart, R. E.
ATMOSPHERIC DIFFUSION OF PARTICULATE MATTER RELEASED FROM AN ELEVATED CONTINUOUS SOURCE.
Univ. Florida, Engineering Progr. Progress Rept. No. 21, Aug. 1967. 23p. (PB 176840) (Presented at: 60th Annual Meeting, Air Pollution Control Association. Cleveland, Ohio, June 11-16, 1967. Paper no. 67-88)

Dustfall experiments were conducted to estimate ground-level deposition pattern. Different size batches of glass microspheres (50 to 200 microns) were continuously released into the atmosphere from an elevated point source. Samplers were placed at ground-level along arcs downwind from the stack and the particles were subsequently identified and counted. Measurements of wind speed, gustiness, and temperature gradient were compared with theory. Two mathematical models are used in the comparison; a three-dimensional classical model by Denisov (comparable to Rounds' two-dimensional solution), and a three-dimensional statistical model by Csanady. Both models assume steady-state conditions, horizontal homogeneity, linear growth relationships for the plume dimensions, and complete particle retention at the ground. It was found that the deposit pattern can be predicted reasonably well by the statistical model but should be restricted to values of $\frac{f}{u}$ and $\frac{f}{\sigma_w}$ ($\bar{u}$ is the mean wind speed, σ_w is the rms value of the vertical velocity fluctuations of the turbulent field and f is the constant free fall velocity of the diffusing material) greater than 0.05 and 1.0 respectively. At lower values of these ratios, the statistical model overestimates the maximum deposition and underestimates its location. The classical model, in general, underestimates the maximum deposition by a factor of approximately 1.5. (Author's Abs.)

135
Went, F. W.
DISPERSION AND DISPOSAL OF ORGANIC MATERIALS IN THE ATMOSPHERE. Desert Research Inst. Reprint Series No. 31. Apr. 1966. 10p.

Approximately 1,000 million tons of volatile organic substances are released per year by vegetation over the whole world. These products have tentatively been identified as terpenes. The author suggests that the dissipation of terpenes and other volatile plant products pass through the same cycle as the dissipation of gasoline vapors in cities; they are photochemically altered by sunlight and result in formation of peroxides, ozonides, or free radicals that later lead to the production of Aitken condensation nuclei. A study of the processes that decrease this organic content of the atmosphere may suggest specific methods to remove man-made pollutants from the air. (Public Health Eng. Abs.)

(b) Meteorology

136

Angell, J. K. and H. Korshover.
BIENNIAL VARIATION IN SPRINGTIME TEMPERATURE AND TOTAL OZONE IN EXTRATROPICAL LATITUDES. Monthly Weather Rev., v. 95: 757-762, Nov. 1967.

During the past decade in extratropical latitudes, springtime stratospheric temperatures tended to be relatively high during the even years and relatively low during the odd years, with some evidence for a phase reversal in the troposphere. In the Southern Hemisphere this even-year stratospheric temperature excess appears to have progressed poleward with time, with the maximum excess occurring near the Tropic of Capricorn in 1955 and near the Antartic Circle in 1965, where the excess averaged 8 °C, even at 100 mb. Total ozone measurements in both hemispheres tend to confirm such a poleward trend. Furthermore, in agreement with a period of order 20 yr, implied by the stratospheric temperature differences, the difference between (springtime) even-year and odd-year total amounts at Arosa, Switzerland, exhibits a 20-yr. periodicity from 1928 to 1956, with ozone amounts averaging 10 percent higher during the spring of the even years around 1960. Springtime surface temperatures in Scandinavia have undergone a similar (15- to 20-yr.) periodicity since 1850, with odd-year temperature excesses averaging 2 °C, around 1959. After 1920, European stations exhibit like variations, but there is little evidence for such surface-temperature fluctuations in North America or in the tropical and temperate latitudes of the Southern Hemisphere. It is suggested that there is an association between the cycling interval of the quasi-biennial tropical oscillation and the above fluctuations of period of order of 20 yr. (Authors' Abs.)

137

Angell, J. K., D. H. Pack, G. C. Holzworth, and others.
TETROON TRAJECTORIES IN URBAN ATMOSPHERE. Jour. Appl. Meteorol., v. 5: 565-572, Oct. 1966.

Tetroon flights at heights near 300 m within the Los Angeles Basin illustrate the useful results to be derived. Tetroon trajectories depict air-flow reversals and yield evidence for diurnal recirculation of air within the Basin. Two flights released simultaneously indicate the existence of helical circulations within marine air over land. Examples are presented of tetroon vertical motions over Palos Verdes Hills. Their pertinence to the study of urban air pollution is discussed. (Eng. Index)

138

Deland, Raymond J. and F. S. Binkowski.
COMPARISON OF WIND AT 500 FEET OVER MINNEAPOLIS AND LOUISVILLE WITH GEOSTROPIC WIND [AIR POLLUTION INVESTIGATIONS]. Jour. Air Poll. Control Assoc., v. 16: 407-410, 1966.

Measurements of wind speed at 500 ft. on a television tower in the Minneapolis-St. Paul area are compared with geostrophic wind speeds and lapse rates. The roughness length for the built-up area surrounding the tower is estimated using geostrophic boundary-layer models. Similar data for Louisville are also considered. The results are relevant to the application of existing boundary-layer models to the estimation of wind speed and turbulent mixing over a city. (Authors' Abs.)

139

Gatz, D. F.
DEPOSITION OF ATMOSPHERIC PARTICULATE MATTER BY CONVECTIVE STORMS: THE ROLE OF THE CONVECTIVE UPDRAFT AS AN INPUT MECHANISM. Thesis (Ph. D.), Michigan Univ., Ann Arbor, Univ. Microfilms, Inc., 1966, 216p.

Quantitative evidence is provided regarding the mechanism by which airborne particulate matter enters convective storms, and the relationships are clarified among (1) time profiles of contaminant concentrations, (2) time profiles of rainfall rate, (3) input mechanism, and (4) mechanism of particle capture, each with respect to two dissimilar contaminants. A field observation program was established near Chickasha, Oklahoma, during May, 1964, to obtain rain scavenging data of high resolution from convective storms. At the field site, sequential samples of rain were collected at frequent intervals for later analysis of their content of artificial radioactivity, plant pollens, and gross residue. Observations were also made of raindrop-size spectra, rainfall, wind and concentrations of pollen in air. Data obtained from the Severe Storms Laboratory and the Agricultural Research Service were used to reconstruct the storms in terms of time sequences of radar echo distributions, rainfall rate distributions, and mesoscale pressure and wind distributions. Conventional synoptic weather data were used to depict large scale flow conditions aloft and at the surface, and to prepare vertical cross-sections of the atmosphere for the time of the storm. A mass-budget analysis of the severe storm of May 10 was undertaken to test the hypothesis that low-altitude input of radioactivity could account for that deposited by the storm. Results show that the total low-altitude input and total deposition are nearly equal. Raindrop evaporation, dilution of contaminants by condensation of excess water, and first precipitation of highly contaminated condensed water all contribute to the observed variations. It is concluded (1) that contaminants deposited in rain from most convective storms are drawn into the storms from low levels of the atmosphere, along with the water vapor, and (2) that temporal variations of contaminant concentration in rain at the ground are generated both within and below the cloud. (APTIC Abs.)

140
Gill, G. C., L. E. Olsson, J. Sela and others.
ACCURACY OF WIND MEASUREMENTS ON TOWERS OR STACKS.
Bull. Amer. Meteorol. Soc., v. 48: 665-674, Sept. 1967.

Wind sensors mounted on towers and smokestacks do not always indicate the true free-air flow. To determine the probable errors in measurements of wind speed and direction around such structures, quarter-scale models have been tested in a large wind tunnel. Data on changes in wind speed and direction were obtained by using smoke, very small wind vanes, and a scale model propeller anemometer. Most emphasis has been placed on a relatively open lattice-type tower, but a solid tower and a stack were also studied. The analysis shows that in the wake of lattice-type towers disturbance is moderate to severe, and that in the wake of solid towers and stacks there is extreme turbulence, with reversal of flow. Recommendations for locating wind sensors in the wind field relative to the supporting structure are given for each of the three structures studied. Guidelines are suggested regarding probable errors in measurements of wind speed and direction around different supporting structures, as outlined below. For an open triangular tower with equal sides D, the wake is about 1-1/2D in width for a distance downwind of at least 6D. Sensors mounted 2 D out from the corner of such a tower will usually measure speeds within + or -10° of that of the undisturbed flow for an arc of about 330°. The disturbance by very dense towers and stacks is much greater. Wind sensors mounted 3 diameters out from the face of a stack will measure wind speeds within + or -10%, and directions within + or -10° of the undisturbed flow for an arc of about 180°. (APTIC Abs.)

141

Halitsky, J.

COMMENT ON WIND TUNNEL SIMULATION OF LARGE-SCALE HORIZONTAL WIND OSCILLATIONS. Atmos. Environ., v. 1: 607-608, 1967.

The difficulties encountered in studying the long-period horizontal fluctuations of the wind on diffusion near a building by use of a proposed model in a wind tunnel are discussed. The simulation could be accomplished by using a steady wind and oscillating a model of the building on a turntable according to a magnetic tape record of an atmospheric wind. This technique would introduce spurious velocities which would affect the diffusion pattern near the building. The extent of the distortion has not been determined. The spurious velocities arise from the tangential velocity points located a distance from the center of rotation of the turntable. When combined with the uniform tunnel airstream velocity, the tangential velocities produce a varying resultant local velocity, relative to the model. There is no counterpart to this effect in the full scale condition. Experiments have demonstrated the sensitivity of diffusion patterns near buildings to orientation to the mean wind, therefore, there is reason to suspect that the varying relative orientation produced by turntable angular velocity may prove significant. Diffusion experiments on chimney jets in a tunnel airstream that is oscillated by means of vanes at a design frequency of about 0.3 c/s, with provision for reducing the frequency still further are being conducted. The intention here is to study the behavior of the jet in a turbulent tunnel wind whose dominant frequency corresponds to that found at chimney height in a full-scale atmosphere. Measurements taken with a nonturbulent wind in the manner described previously are to be intergrated for comparison with measurements in the turbulent wind. (APTIC Abs.)

142

Hass, W. A., W. H. Hoecker, D. H. Pack, and others

ANALYSIS OF LOW-LEVEL, CONSTANT VOLUME BALLOON (TETROON) FLIGHTS OVER NEW YORK CITY. Quarterly Journal of the Royal Meteorological Society (London), v. 93: 483-493, Oct. 1967.

Constant volume balloon (tetroon) flights made over New York City at heights of about 300 meters during June of 1965 are analyzed. The transponder-equipped tetroons were tracked to distances exceeding 100 km by means of the wsr-57 weather radar located in Central Manhattan. On non-sea breeze days the tetroons tend to move towards low pressure with an angle of 35 degrees, and to move with about two-thirds of the geostrophic wind speed. There is a correlation of 0.73 between lapse rate and tetroon-derived r.m.s. vertical velocity, and of 0.43 between lapse rate and Lagrangian period of vertical oscillation. Tetroon-derived vertical velocities are also used to obtain estimates of the mean Reynolds stress (1.3 dynes cm^{-2} at flight level) and the downwind variation of vertical diffusion over an urban area. (Authors' Abs.)

143
Holzworth, G. C.
MIXING DEPTHS, WIND SPEEDS AND AIR POLLUTION POTENTIAL FOR SELECTED LOCATIONS IN THE UNITED STATES. Jour. Appl. Meterol., v. 6: 500-515, Dec. 1967.

Daily estimates of morning and afternoon mixing depths and average wind speeds through the mixing layers were calculated and summarized for seven locations in several climatic regions of the contiguous United States. Mixing depth and wind speed estimates were based on regular surface (airways) and upper air (rawinsonde) observations of the Weather Bureau and on the assumption of a dry-adiabatic lapse rate in the mixing layer. Monthly averages of morning and afternoon mixing depth and wind speed are presented graphically. The frequency of occurrence of various combinations of mixing depth and wind speed classes were used in an urban diffusion model to calculate theoretical values of relative pollutant concentration for four major cities. These relative pollutant concentrations, which also depend upon city size, are compared among the cities on the bases of their current sizes and a common size. (Author's Abs.)

144
Landsberg, H. E.
AIR POLLUTION AND URBAN CLIMATE. In: Biometeorology, v. 2, pt. 2. Ed. by S. W. Tromp and W. H. Weike. New York, Pergamon Press, 1967, p. 648-656. (Proc. 3rd Internat. Biometerological Cong. Pau, France, Sept. 1-7, 1963).

Air pollutants, which have become a major health menace, show essentially similar behavior under the influence of meteorological factors, regardless of type and origin. In American metropolitan areas pollution concentrations are, by and large, a function of population density. As a dispersant the wind is the factor of primary importance; precipitation is next in effectiveness. In dry weather with low wind speeds intensity of solar radiation governs the production of irritating oxidants. Persistent stagnation conditions with low-level inversions will create in some industrial regions hazardous levels of pollution with increasing frequency. Adequate warnings can be issued but if proper control measures of the sources are neglected, the outlook for the industrial areas of the world is pessimistic. (Author's Abs.)

145
Leone, I. A., E. Brennan, and R. H. Daines
THE RELATION OF WIND PARAMETERS IN DETERMINING OXIDANT CONCENTRATIONS IN TWO NEW JERSEY COMMUNITIES. Atmos. Environ., v. 2: 25-33, 1968.

A 2-year study of the relation of wind speed and direction to total oxidant (including O_3) concentration and phytotoxicity was made of 2 New Jersey communities, Carlstadt and New Brunswick, where air pollution damage to vegetation was frequently observed. Results obtained during a 4-hr. period from 11:00 to 15:00 local time indicated a negative correlation between wind speed and oxidant concentration which was significant (at $P = 0.05$) during all months of the year. Winds originating from the directions of heavily populated and dustrialized areas with respect to each community were associated with oxidant concentrations which were significantly higher than those occurring when winds proceeded from suburban or residential areas. While wind speed was not related to the build-up of the very low concentrations required to injure extremely sensitive tobacco plants (0.035 ppm.), higher concentrations (>0.060 ppm.) correlated very well with changes in wind speed. Whereas 46% of all the oxidant concentrations >0.035 ppm. occurred when the wind was less than 4 m.p.h. in velocity, 90% of the concentrations >0.060 ppm. occurred when wind speed was at this low level. As with earlier results for SO_2 concentrations, the majority of potentially phytotoxic concentrations in Carlstadt or those which could be injurious to sensitive crops if grown in the area were associated with the winds originating from the northeast and southwest. Concentrations at this level rarely occurred when the wind was from due north. (Chem. Abs.)

146
Ludwig, J. H. and R. A. McCormick
THE METEOROLOGY PROGRAM OF THE NATIONAL CENTER FOR AIR POLLUTION CONTROL. Bull. Amer. Meteorol. Soc., v. 49: 823-829, Aug. 1968.

A detailed discussion of the meteorological activities of NCAPC and their close relationships to other phases of the Center's research and operational programs is presented. The research activities include studies on: (1) forecasting air pollution potential, (2) transport and diffusion of air pollutants, (3) boundary layers, (4) instrumentation, and (5) air pollution climatology. The objectives and outlook for the NCAPC are discussed.

147
MacCready, P. B., Jr.
INSTRUMENTATION REQUIREMENTS FOR METEOROLOGICAL RESEARCH. In: Symposium, Air Pollution Instrumentation, Los Angeles, Calif., Oct. 1965. Ed. by D. F. Adams. Pittsburgh, Pa., Instrument Society of America, 1966, p. 4-8.

Ground measurements of air pollution are quite uncomplicated, utilizing rotating cup anemometers and direction vanes. Automatic weather stations which record wind speed, direction, temperature and other variables are becoming popular since they put out their data in digital form. Measurements aloft are more difficult. Balloons (tracked by radar or helicopter), fluorescent particles (tracers), and airplanes equipped with sensors are a few of the ways measurements are made. The use of well equipped airplanes is the most promising for future use.

148
McCormick, R. A.
AIR POLLUTION CLIMATOLOGY. In: Air Pollution. v. I. Air Pollution and Its Effects, Ed. by A. C. Stern. New York Academic Press, 1968, p. 275-320.

The sources of and the representativeness (influence of sensor placement on its readings) of aerometric (i. e. meteorological and quality) data are discussed. The fundamental elements and mechanisms making up the air pollution climatology of a region are everywhere existent, differing only in degree of importance of one or more of the contributing factors (temperature, ventilation-transport and diffusion of air pollutants, solar radiation, visibility, and moisture). The climatological features of urban air pollutants and the climatology of "background" contamination are considered separately due to the greatly higher concentration of air pollutants in the urban areas.

149
Miller, M. E.
FORECASTING AFTERNOON MIXING DEPTHS AND TRANSPORT WIND SPEEDS. Monthly Weather Rev., v. 95: 35-44, Jan. 1967.

A method is presented to estimate the vertical extent of atmospheric mixing during the afternoon and the average transport wind speed, i. e., the average wind speed within the mixing layer. Sample forecasts, made during April and May 1966, have shown that the products are satisfactory enough to be incorporated into the National Air Pollution Potential Forecast Program. (Public Health Eng. Abs.)

150
Panofsky, H. A., N. Busch, B. Prasad, and others.
PROPERTIES OF WIND AND TEMPERATURE AT ROUND HILL, SOUTH DARTMOUTH, MASS. Pennsylvania State Univ., University Park, Final rept. July 15, 1966-July 14, 1967. 95p. incl. refs. (Contract DA AB07-67-C-0035) AD 659430

Studies of the properties of mean and fluctuating atmospheric characteristics near the ground at Round Hill, South Dartmouth, Mass. are summarized. It was possible to find out which characteristics of low-level flow are essentially universal, and which are dependent on equilibrium of the air. Tentative conclusions reached in the report are: (1) The ratio of lateral to longitudinal spectra in the inertial range does approach the predicted value of 4/3, provided the height is large compared to the wavelength. The height-wavelength ratio must be at least 6 in the case of the vertical-velocity spectrum; (2) Normalized cospectra and vertical-velocity spectra obey similarity theory; (3) Normalized longitudinal spectra do not obey similarity theory; (4) At locations where the air flow is in approximate equilibrium, the sum of buoyant and mechanical energy production appears to be balanced by local dissipation. At levels where air flowing from rough to smooth terrain is farthest from equilibrium, dissipation far exceeds the production; (5) At levels which are in approximate equilibrium, the nondimensional wind shear varies with Richardson number in the same manner as at horizontally homogeneous sites. But, in accelerating air, this wind shear is much smaller, even in neutral air, by a factor as large as two; (6) The ratio of exchange coefficients at Round Hill is reasonably consistent with that obtained over homogeneous sites; and (7) Variances of velocity and temperature from many sites have been brought together. Those of temperature and vertical motion agree with similarity theory. Nomograms for the estimation of these variances are given. (APTIC Abs.)

151
Panofsky, H. A. and B. Prasad.
THE EFFECT OF METEOROLOGICAL FACTORS ON AIR POLLUTION IN A NARROW VALLEY. Jour. Appl. Meteorol., v. 6: 493-499, June 1967.

The Air Pollution Division of the State of Pennsylvania has conducted simultaneous measurements of meteorological variables and air quality at Johnstown, Pa. An analysis of the observations for two fall seasons showed the fluctuations can be fairly well explained by the changes in wind speed and fluctuations of vertical air velocities. Wind direction is relatively unimportant, except for the rare east winds, when the air at Johnstown is affected by a major steel plant. This paper presents a simple mathematical model that predicts variations in air pollution from a large number of low-level sources in a narrow valley. This theory and observations are in good agreement. It is likely, therefore, that most of the pollution at Johnstown and similar sites is locally produced. Due to the fact that there usually are no important high-stack sources upwind at Johnstown at present, fumigation is not generally a factor there. (Air Poll. Abs.)

152
Schuck, E. A., J. N. Pitts, Jr., and J. K. S. Wan.
RELATIONSHIPS BETWEEN CERTAIN METEOROLOGICAL FACTORS AND PHOTOCHEMICAL SMOG. Air and Water Poll; Internat. Jour., v. 10: 689-711, 1966.

By a method of averaging, involving a large amount of atmospheric monitoring data, interesting and valid information on the formation and intensities of smog symptoms can be obtained. The concentration of maximum daily oxidant is a function of day of the week and this function might be related to automotive traffic patterns. The weekend daily temperatures are also affected presumably by the same factors which influence the weekend oxidant intensity. Both weekend oxidant and temperature effects suggest that the magnitude of local pollution is more important than horizontal transport in determining the weekly pattern of smog symptoms at any given station. Horizontal transport and inversion height seem to be important in determining the absolute magnitude of these symptoms. Thus changes in inversion height and wind speed appear to account for 2 fold changes in maximum daily oxidant values. Maximum daily oxidant concentration was also found to be directly related to the square root of light intensity with little if any dependence on temperature. The oxides of nitrogen concentrations are inversely related to inversion height and wind speed, are independent of light intensity, and are some complex function of temperature. Hydrocarbon and carbon monoxide concentrations appear to be independent of temperature. Pollution levels are proportional to each other over large areas of the Los Angeles Basin. Early morning pollution levels are proportional to smog intensities noted for that day and intensity of smog symptoms may be governed in the atmosphere by the same parameters known to govern smog intensities in laboratory experiments. Thus the analysis of atmospheric data indicates that variable hydrocarbon to oxides of nitrogen ratios do exist in the atmosphere and that there exists a dependence of atmospheric smog symptom intensity upon this ratio. When the atmospheric data are analyzed in terms of early morning pollution concentrations and resulting smog intensities the results predict that control of the intensity of certain smog symptoms is directly proportional to the control of hydrocarbons. These data predict that control of oxides of nitrogen will not produce an effect on the intensity of certain smog symptoms until the degree of oxides of nitrogen control is much greater than 50%. (Authors' Abs.)

153

Smith, M. E. and I. A. Singer.
AN IMPROVED METHOD OF ESTIMATING CONCENTRATIONS AND RELATED PHENOMENA FROM A POINT SOURCE EMISSION. Jour. Appl. Meteorol., v. 5: 631-639, Oct. 1966.

The meteorological features of a refined air pollution evaluation technique are described. Time and space variations of wind speed, dispersion parameters and capping inversions are permitted, and it is believed that the estimates of dispersion at large distances from the source are more realistic than those obtained with simple models. (Air Poll. Abs.)

154

Wanta, R. C.
METEOROLOGY AND AIR POLLUTION. In: Air Pollution. v. I. Air Pollution and Its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 187-226.

Details of the temperature and wind structure which form the background of atmospheric diffusion and stirring are emphasized. The concept of atmospheric stability is dwelt on because of its comparative unfamiliarity to nonmeteorologists. While quantitative employment of stability in atmospheric diffusion estimates is at present not feasible, it serves to explain qualitatively variations in the power of the atmosphere to dilute pollutants, and furthermore is an excellent parameter for categorizing meteorological statistics relating to air pollution. (Author's Abs., Modified)

155

Worth, J. J. B., L. A. Ripperton, and C. R. Berry
OZONE VARIABILITY IN MOUNTAINOUS TERRAIN. Jour. Geophys. Research, v. 72: 2063-2068, Apr., 15, 1967.

Meteorological and chemical factors that may affect concentration of ozone in the atmosphere over a mountain-valley complex are discussed. Temperature, humidity, wind speed and direction, sunlight intensity, and concentrations of ozone, nitric oxide, and nitrogen dioxide were measured and recorded. The field test sites were on top of Green Knob, in the southern Appalachian mountains approximately 51 km northeast of Asheville, North Carolina. Two

15-meter towers were erected for the field sampling program. The principal tower site was in a clearing on top of Green Knob and a second 15-meter tower site was in a valley. It was concluded that the ozone concentration on a mountaintop and in a valley do not exhibit the same mean value, nor do their diurnal maximum concentrations necessarily occur at a comparable time. The mean ozone concentration values on the mountaintop during the summer season were larger by a factor of 2 to 3 than those values associated with valley and lowland sites located in geographical proximity. The time and occurrence of the maximum values for the two southern Appalachian sites occurred approximately 180° out of phase with the maximums occurring at night on the mountaintop. Ozone concentrations in the boundary layer of the troposphere appear to be related to the thermal stability of the air. The average NO_2 concentration was found to be 0.40 pphm and the average observed concentration for NO was 0.26 pphm. The apparent nocturnal existence of NO and O_3 in measurable concentration is of significance in that dynamic chemistry and published reaction rate constants suggest that only the one in excess would survive the night. (APTIC Abs.)

(c) Photochemical reactions

156

Altshuller, A. P.
REACTIVITY OF ORGANIC SUBSTANCES IN ATMOSPHERIC PHOTOOXIDATION REACTIONS. Air and Water Poll.; Internat. Jour., v. 10: 713-733, Oct. 1966.

The organic vapors emitted to urban atmospheres by motor vehicles and other sources of emissions consist not only of paraffinic, acetylenic, aromatic, and olefinic hydrocarbons, but also of aldehydes, ketones, alcohols, and chlorinated hydrocarbons. To estimate the contribution of each of these classes of compounds to photochemical smog, one must know both their atmospheric concentrations and their relative reactivities in atmospheric reactions. A review of the available literature on concentration levels of organic vapors in urban atmospheres indicates that much more analytical work is needed. The existing data are adequate, however, for the formulation of useful estimates. Reactivities of organic substances in photooxidation reactions can be considered from many standpoints. Rates of disappearance of the organic substances, rates of disappearance of nitric oxide or of formation and disappearance of nitrogen dioxide, and rates or maximum yields of various products such as oxidant or organic nitrates all can be used as chemical measurements of reactivity. Eye irritation, various types of plant damage, and aerosol formation are indicators of reactivity that can be related only to a limited extent to chemical measurements of rates of reaction. Reactivity measurements based on biological effects, aerosols and yields of biologically active products are of the greatest significance. The problems of developing a single index of reactivity are considered. The application of reactivity measurements to automobile exhaust composition, to control devices, and to improvements in atmospheric purity is discussed. (Air Poll. Abs.)

157

Altshuller, A. P., I. R. Cohen, and T. C. Purcell.
PHOTOOXIDATION OF HYDROCARBONS IN THE PRESENCE OF ALIPATHIC ALDEHYDES. Science, v. 156: 937-939, 1967.

A new group of gasphase reactions have been shown to contribute to the photooxidation of hydrocarbons. The photooxidation of aliphatic aldehydes at wavelengths below 3400 angstroms produces intermediates that react with olefinic and aromatic hydrocarbons. Although the photooxidation rates are slower than those induced by nitrogen oxide, the rates are significant, considering the interest in urban atmospheric reactions. These results may indicate that the control of nitrogen oxides alone may not effectively reduce photochemical air pollution. (Authors' Abs.)

158

Altshuller, A. P., I. R. Cohen, and T. C. Purcell.
PHOTOOXIDATION OF PROPIONALDEHYDE AT LOW PARTIAL PRESSURES OF ALDEHYDE. Canadian Journal of Chemistry (Ottawa), v. 44: 2973-2979, 1966.

Propionaldehyde at partial pressures of from 0.0006 to 0.04 mm was photooxidized at 3100 Å in the presence of 150 mm of O. The major products were ethyl hydroperoxide and CO. Acetaldehyde was formed at intermediate concentrations and HCHO, EtOH, MeOH, H_2O_2, and ethane were minor products. No ozone, peroxy acids, or diacyl peroxides could be detected. The results can be explained on the basis of a free-radical mechanism. Certain radical disproportionation reactions which are often postulated are unimportant because of the low partial pressures of propionaldehyde. An alternative mechanism involving direct chemical reaction of an O molecule with the triplet state of the propionaldehyde may be of some significance, but cannot account for all of the products obtained. The results indicate the importance of alkyl hydroperoxides as products in photooxidations at low partial pressures of aldehyde in the presence of large excesses of O. (Chem. Abs.)

159
Altshuller, A. P., S. L. Kopczynski, W. Lonneman, and others.
PHOTOCHEMICAL REACTIVITIES OF EXHAUSTS FROM 1966 MODEL AUTOMOBILES EQUIPPED TO REDUCE HYDROCARBON EMISSIONS. Jour. Air. Poll. Control Assoc., v. 17: 734-737, Nov. 1967.

Exhaust control device equipped vehicles and vehicles maintained under lean operating conditions show reduction in exhaust reactivity as measured in uv radiation chambers. The incidence of eye-irratation, O_3, and peroxyacetyl nitrate are less than similar treatment with vehicles maintained under rich operating conditions. Improvement is associated with the reduction in hydrocarbon to N oxides ratio. Photochemically generated aldehydes are lower in irradiated exhaust from device equipped vehicles than from unequipped vehicles. Exhaust reactivity is not equivalent to hydrocarbon reactivity. (Chem. Abs.)

160
Bufalini, J. J. and A. P. Altshuller.
SYNERGISTIC EFFECTS IN PHOTOOXIDATION OF MIXED HYDROCARBONS. Environ. Sci. & Technol., v. 1: 133-138, Feb. 1967.

The purpose of this work is to test the validity of the excess rate hypothesis. One-butene was irradiated with NO_2, with NO_2 in the presence of trans-2-butene, and with NO_2 in the presence of mesitylene. The tests showed that an excess rate exists. The experimental evidence indicates that it arises from the free radicals produced by atomic oxygen-hydrocarbon reactions. The presence of slow-reacting hydrocarbons will decrease the reactivity of faster reacting hydrocarbons, conversely, the presence of fast reacting hydrocarbons will increase the reactivity of slower reacting hydrocarbons. (Eng. Index)

161
Cohen, I. R., T. C. Purcell, and A. P. Altshuller.
ANALYSIS OF THE OXIDANT IN PHOTOOXIDATION REACTIONS. Environ. Sci. & Technol., v. 1: 247-252, Mar. 1967.

A number of methods for determining the identity and concentration of the oxidants produced photochemically in model systems are applied to atmospheric sampling. The Griess-Ilosvay and neutral potassium iodide reagents are evaluated. A novel molybdate-catalyzed potassium iodide reagent and a modification of the ferrous thiocyanate method are presented. The titanium (IV)-hydrogen peroxide complex as a tool in peroxide analysis has high specificity but relatively low sensitivity. The recently published Hauser and Bradley ozone determination is not absolutely specific for ozone. The selectivity and sensitivity of the Mast microcoulometer and the Mark IV ultraviolet photometer are included. The effects of the following variables are considered: spectral characteristics of the reagent blends and the colored species in question; temperature; order of addition, color stability, and rate of color formation; reagent concentrations; hydrogen ion concentration (pH); and various determinate errors. Calibration curves, molar absorptivities. and interferences are presented in detail. (Authors' Abs.)

162

Estes, F. L.

THE EFFECT OF INITIAL CONCENTRATION OF REACTANTS ON THE BIOLOGICAL EFFECTIVENESS OF PHOTOCHEMICAL REACTION PRODUCTS. Atmos. Environ., v. 1: 159-170, Mar. 1967.

Synthetic air pollution mixtures were produced by the irradiation of air containing nitrogen dioxide and butene-1 in an all-glass flowing system. The percentage of butene-1 consumed increased with the initial nitrogen dioxide concentration in the range of 2.3 to 4.5 ppm. Further increase in the nitrogen dioxide concentration led to less butene disappearance. After the first 40-60 min. of irradiation, the amount of butene and of nitrogen dioxide which disappeared was constant. This observation, along with the small variations in oxidant analysis, suggested that photochemical products were not markedly changed with time. The amount of the reactants consumed and the inhibition of the subsequent growth of E. coli was a function of the initial ratio of the reactants. A butene-nitrogen dioxide ratio of 20 was most inhibiting. On doubling the concentration of the reactants, the inhibition factor doubled also. When the activity was determined with a glutamate substrate, the decrease in activity of glutamic dehydrogenase was linear with time of exposure of the enzyme. The activity of the enzyme was less inhibited in the reverse direction with an α-keto glutarate substrate. (Author's Abs.)

163

Goetz, A. and R. Pueschel.

BASIC MECHANISMS OF PHOTOCHEMICAL AEROSOL FORMATION. Atmos. Environ., v. 1: 287-306, 1967.

A previously described dynamic photochemical reactor was applied to studies of the effects of sulfur dioxide humidity, and order of mixing of reactants on the photochemical production of aerosol from 1-octene and nitrogen dioxide in air. The effects of all three parameters are complex but explainable from a few reasonable assumptions, the most important of which is probably that initial contact between the aerosol nuclei and the more polar reactants has a governing effect on the nature of the product. (Authors' Abs.)

164
Jaffe, L. S.
PHOTOCHEMICAL AIR POLLUTANTS AND THEIR EFFECTS ON MEN AND ANIMALS. I. GENERAL CHARACTERISTICS AND COMMUNITY CONCENTRATIONS. Arch. Environ. Health, v. 15: 782-791, Dec. 1967.

The physical and chemical characteristics of photochemical smog and the photochemical oxidants are described. Aerometric data on the "total oxidant" concentrations found in the large urban communities affiliated with the Public Health Service, Continuous Air Monitoring Program (CAMP) network are documented for 1964 and 1965. Similarly, the number of days on which the "total oxidant" concentrations equalled or exceeded 0.05, 0.1, and 0.15 ppm, respectively, has been delineated for each of the affiliated cities in this network. The 0.05 ppm and 0.1 ppm levels are routinely found and are exceeded in all of the cities affiliated with this network for highly significant percentages of days of the year, while the 0.15 ppm level is exceeded only in Los Angeles thus far for a significant percentage of the total number of days of the year. However, much higher maximum hourly and maximum five-minute levels are attained in all of the cities (but one) during the year. (APTIC Abs.)

165
Khan, A. U., J. N. Pitts, Jr., and E. B. Smith.
ROLE OF SINGLET MOLECULAR OXYGEN IN PRODUCTION OF PHOTOCHEMICAL AIR POLLUTION. Environ. Sci. & Technol., v. 1: 656-657, Aug. 1967.

A new mechanism is proposed to explain the rapid conversion of NO into NO_2 with the concurrent disappearance of hydrocarbons and the appearance of oxidants in photochemical air pollution. Singlet oxygen generated by triplet energy transfer from strongly absorbing polynuclear aromatic hydrocarbons to normal oxygen produces excited singlet molecular oxygen which attacks olefins to give unstable peroxides. The solution of differential equations relating to the proposed mechanism yields a set of rate-time curves for NO--NO_2—NO_3 which have the same general characteristics as those observed in actual smoggy atmospheres. (Eng. Index)

166
Purcell, T. C. and I. R. Cohen.
PHOTOOXIDATION OF FORMALDEHYDE AT LOW PARTIAL PRESSURES OF ALDEHYDE. Environ. Sci. & Technol., v. 1: 845-846, 1967.

The oxidant produced by the photooxidation of HCHO at low partial pressures of aldehyde was identified as H_2O_2. The apparent molecular imbalance between the peroxide formed and the HCHO consumed is attributable, at least in part, to surface effects related to the reaction container. (Chem. Abs.)

167
Randerson, D.
A STUDY OF AIR POLLUTION SOURCES AS VIEWED BY EARTH SATELLITES. Jour. Air Poll. Control Assoc., v. 18: 249-253, Apr. 1968. (Presented at: 60th Annual Meeting Air Poll. Control Assoc., Cleveland, Ohio. June 11-16, 1967. Paper no. 67-129).

Several photographs are presented which illustrate the large scale dispersion of atmospheric pollutants. These photographs were taken by astronauts on various manned spacecraft flights. A spacecraft view of a forest fire in the Apalachicola National Forest revealed a rather large smoke plume. Geometrically scaled measurements indicated the plume was approximately 4 miles wide and about 65 miles long. Trapped under a frontal inversion located between 2500 and 3000 ft above ground level, this plume was being transported south-southwestward into the Gulf of Mexico by the local wind flow pattern. Several pictures containing examples of industrial smoke plumes in the vicinity of Houston, Tex., are discussed in relation to the local synoptic situation. A picture of industrial haze over Houston, Tex., is presented to illustrate an areal distribution of atmospheric pollutants covering an area of about 2600 square miles. (Author's Abs.)

168
Rummerfield, P. S., J. Cholak, and J. Kereiakes.
ESTIMATION OF LOCAL DIFFUSION OF POLLUTANTS FROM A CHIMNEY: A PROTOTYPE STUDY EMPLOYING AN ACTIVATED TRACER. Amer. Indus. Hyg. Assoc. Jour., v. 28: 366-371, July-Aug. 1967.

From wind tunnel studies, models were previously developed to predict pollutant concentrations around buildings from short vents. The equations (with some modifications), evaluated for outdoor conditions, were found to give accurate predictions. The model for prediction within the building cavity and two other models, applicable beyond the cavity, were evaluated. A tracer was burned in an incinerator. Stack emissions were isokinetically collected on filter papers. Field samples around the building were also collected on filter papers. The samples were activated in a nuclear reactor. The tracer was then separated and counted. In 13 tests (114 samples) most actual versus predicted dilutions differed by less than a factor of 3. In only one case was the difference greater than a factor of 7. (APTIC Abs.)

169
Schuck, E. A. and E. R. Stephens.
QUANTUM YIELDS DURING DILUTE GAS PHASE PHOTOLYSIS OF ETHYL NITRITE IN 3500 Å REGION. Environ. Sci. & Technol., v. 1: 138-143, Feb. 1967.

Parts per million concentrations of ethyl nitrite (EtONO) were photolyzed in the absence and presence of added nitrogen or NO. The light source employed had its intensity maximum at 3500 Å with 85% of its energy confined to the 3300 to 3750 Å region. A mechanistic approximation of results can be obtained by assuming the existence of two equally important primary processes: (1) cleavage at RO-NO bond and (2) the formation of excited state. Recombination of initial fragments from RO-NO bond cleavage and collisional deactivation of excited state appear to be the important secondary reactions. The choice between these two primary steps may involve rotational isomers; thus, intramolecular rearrangement of excited cis-isomer may be a major source of CH_3CHO. (Eng. Index)

170
Schuck, E. A., E. R. Stephens, and R. R. Schrock.
RATE CONSTANT RATIOS DURING NITROGEN DIOXIDE PHOTOLYSIS. Jour. Air. Poll. Control Assoc., v. 16: 695-696, 1966.

Nitrogen dioxide is the light absorber in the hydrocarbon system leading to production of photochemical air pollution. Studies of the reactions involved are based on the kinetics of nitrogen dioxide photolysis and the values of the rate constants derived therefrom. The photolysis of nitrogen dioxide was investigated in the 2-20 ppm concentration range. The value of the bimolecular rate constant of the reaction between oxygen atoms and nitrogen dioxide was calculated to be 5.26×10^9 l mole^{-1} sec^{-2}, and the termolecular rate constant of the reaction between oxygen atoms and nitrogen dioxide in presence of a 3rd body is 4.24×10^{-10} l^2 mole^{-2} sec^{-1}. The rate constant for the reaction between oxygen atoms and nitric oxide in the presence of a 3rd body was calculated to be 2.31 x 10^{10} l^2 $mole^{-2}$ sec^{-1}. Nitrogen was used as the 3rd body. In terms of order of magnitude these calculated rate constants are similar to previously reported values. However, in certain cases their use leads to an oxygen atom concentration which is 100% greater than previously calculated. (Authors' Abs.)

171
Singer, I. A., J. A. Frizzola, and M. E. Smith.
A SIMPLIFIED METHOD OF ESTIMATING ATMOSPHERIC DIFFUSION PARAMETERS. Jour. Air Poll. Control Assoc., v. 16: 584-596, 1966.

Studies at Brookhaven National Laboratory have revealed reliable relationships among the statistical properties of the three-dimensional wind components. Combining these results with functions relating these wind statistics to atmospheric diffusion has produced a simplified system for estimating diffusion parameters from a variety of instrument arrangements. The system is described; examples of its application are given. (Authors' Abs.)

172
Smith, D. B.
TRACER STUDY IN AN URBAN VALLEY. Jour. Air Poll. Control Assoc., v. 18: 466-471, July 1968. (Presented at: 60th Annual Meeting Air Poll. Control Assoc., Cleveland, Ohio. June 11-16, 1967. Paper no. 67-134).

Results of a series of nighttime tracer experiments conducted during the Autumn of 1966 in the industrialized valley of Johnstown, Pa., are discussed. Quite atypical meteorology and dispersion occur within a classical drainage flow framework. An urban heat island effect is observed creating uniform temperature and wind structures within a layer of air flowing through the valley. Dispersion in the valley at night is comparable to that of neutral conditions over open country. (Author's Abs.)

173
Tebbens, B. D., J. F. Thomas, and M. Mukai.
FATE OF ARENES INCORPORATED WITH AIRBORNE SOOT. Amer. Indus. Hyg. Assoc. Jour., v. 27: 415-422, 1966.

Fluorescent irradiation up to 1/4 of the intensity of the noon sunlight of smoke from the burning of C_3H_8 causes the modification or disappearance of 35-65% of the arenes originally present. Although O increases the degree, it is not necessary for modification. The increase in arenes without irradiation is considered to be a function of the system and particle size factors. (Chem. Abs.)

174
Thomas, J. E., M. Mukai, and B. D. Tebbens.
FATE OF AIRBORNE BENSO[A]PYRENE. Environ. Sci. & Technol., v. 2: 33-39, Jan. 1968.

Little is known of the fate of arenes in the atmosphere. To gain some knowledge of behavior of these arenes, benzo[a]-pyrene in solid phase was studied under various treatments. Infrared analyses were used to describe the changes which occurred under treatment (900 to 700 cm^{-1} out-of-plane C—H bending vibration). Other isomers of B(a)P, perylene and B(e)P, and a few other polynuclear aromatic hydrocarbons did not show any changes in infrared curves under the same treatments. Hypothetical structural analyses also were postulated regarding the soot and polynuclear aromatic hydrocarbons, as polynuclear aromatic hydrocarbons do not exist when there is no soot. (Authors' Abs.)

175
Wayne, L. G.
EYE IRRITATION AS A BIOLOGICAL INDICATOR OF PHOTOCHEMICAL REACTIONS IN THE ATMOSPHERE. Atmos. Environ., v. 1: 97-104, 1967.

Studies involving the quantitation of eye irritation produced by experimental exposure of humans to synthetic atmospheres are discussed. The principal methods used are panel measurements of intensity, threshold, or response delay. Advantages and difficulties of each method are reviewed, as well as characteristics of the data generated and appropriate means of manipulating the data. Evidence regarding the possible chemical identity of irritants in photochemical smog is discussed, leading to the conclusion that not all observed eye irritation is accounted for by additive effect of formaldehyde, acrolein, and peroxyacyl nitrates. Implications of the findings for air pollution control policies are considered. As one of the undesirable manifestations of photochemical smog, eye irritation has been the subject of a number of studies in recent years. Several of these studies are reviewed with particular reference to those aspects relevant to air pollution research and air pollution control policy. (Author's Abs.)

IV. MEASUREMENT

176

Altshuller, A. P.
AIR POLLUTION. Anal. Chem., v. 39: 10R-21R, 1967.

The work reported on air pollution primarily from Nov. 1964-Nov. 1966 is reviewed with 297 references. The subjects included are biological indicators, sampling and calibration methods, inorganic and organic particulates, aerosols, inorganic and organic gaseous pollutants, analyses of pollution sources, and field studies. (Chem. Abs.)

177

Altshuller, A. P., S. L. Kopczynski, W. A. Lonneman and others.
CHEMICAL ASPECTS OF PHOTOOXIDATION OF PROPYLENE-NITROGEN OXIDE SYSTEM. Environ. Sci. & Technol., v. 1: 899-914, Nov. 1967.

Product yields were measured over a wide range of reactant concentrations and reactant ratios. Nitrogen dioxide, oxidant (ozone and other oxidizing agents), formaldehyde, acetaldehyde, carbon monoxide, peroxyacetyl nitrate, and methyl nitrate were measured by colorimetric, gas chromatographic, and various monitoring instruments. The mechanism of reactions involved is considered, including stoichiometry and the role of free radical intermediates. The carbon and nitrogen balances are computed and the difficulties in obtaining balances considered. (Eng. Index)

178

Caretto, L. S.
TRACER TECHNIQUES CAN BE USED TO STUDY AUTO EXHAUST EMISSIONS. Chem. Eng. News, v. 46: 15, June 1968.

Isotopic trace techniques were used to examine the connection between engine operating conditions and composition of exhaust fumes, particularly with reference to the formation of unburnt exhaust hydrocarbons. This summary of a paper delivered (by Caretto) at the Society of Automotive Engineers' meeting in Detroit reports that studies on the rotary Wankel engine showed that the contribution of fuel oil to the total unburned hydrocarbon in the exhaust was the same as the percentage of oil in the original fuel mixture. (Air Poll. Abs.)

179
Charlson, R. J.
AN INTEGRATING NEPHELOMETER FOR STUDIES OF AIR POLLUTION AEROSOLS. Jour. Air Poll. Control Assoc., v. 17: 585, Sept. 1967.

Any device for assessing the visual quality of air must necessarily have an extremely high sensitivity since, at times, the Rayleigh scattering of air molecules is the determining factor. The integrating Nephelometer of Brewer and Beuttell has been adapted for air quality measurement. The results may be interpreted in terms of visual range; if so, the inherent noise in the system corresponds to more than 500 mi, (800 km) visual range with a 100-sec response time. The low cost, simplicity, and sensitivity of the device make it appear useful for rapid evaluation of visual air quality. Eight months of continuous 24-hr, 7-day operation have resulted in a high degree of reliability in the instrument. Correlation of atmospheric scattering coefficient with the aerosol mass has resulted in a linear regression represented by mass/volume, $\mu g/m^3 = 3 \times 10^5$ (scattering coefficient, m^{-1}), or using Middleton's definition of meteorological range, the product of (visual range) x mass/volume yields a constant of about 1 g/m^2, the mass of aerosol necessary (per square meter) for the determination of the visibility. (Air Poll. Abs.)

180
Charlson, R. J., H. Horvath, and R. F. Pueschel.
THE DIRECT MEASUREMENT OF ATMOSPHERIC LIGHT SCATTERING COEFFICIENT FOR STUDIES OF VISIBILITY AND POLLUTION. Atmos. Environ., v. 1: 469-478, July 1967.

The integrating nephelometer of Beuttel and Brewer has been modified for studies of air pollution. The instrument, which is simple, stable, and inexpensive to construct, has been operated continuously for several months. Interpretation of the data is simplified by use of a theoretical approach which indicates that the measured light scattering coefficient is proportional to the mass of suspended particulates for well-aged atmospheric aerosols. (Authors' Abs.)

181
Cohen, I. R.
3-METHYL-2-BENZOTHIAZOLONE HYDRAZONE METHOD FOR ALDEHYDES IN AIR: COLLECTION EFFICIENCIES AND MOLAR ABSORPTIVITIES. Anal. Chem., v. 38: 1418, Sept. 1966.

Collection efficiencies for propionaldehyde in nitrogen for both acetaldehyde and propionaldehyde in air were determined, and molar absorptivities were obtained for the products formed by acetaldehyde and propionaldehyde. Comparisons of relative intensities show that the modified procedure on the average was 6 times more sensitive than the original procedure for propionaldehyde and about 7 times more sensitive for acetaldehyde. (Public Health Eng. Abs.)

182
Farmer, J. R. and J. D. Williams.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: III AIR QUALITY MEASUREMENTS. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, Dec. 1966, 182p.

Methods are described for the measurement of the following pollutants in the St. Louis survey: (1) suspended particulates, (2) dustfall, (3) sulphation, (4) sulphur dioxide, (5) total oxidants, (6) materials deterioration, (7) visibility, (8) atmospheric turbidity, (9) aeroallergens, and (10) hydrogen sulphide. This is followed by a detailed discussion of the results illustrated by diagrams and tables. (Air Poll. Abs.)

183
Ferguson, J. S. and E. G. Sheridan.
SOME APPLICATIONS OF MICROSCOPY TO AIR POLLUTION. Jour. Air. Poll. Control Assoc., v. 16: 669-672, 1966.

The microscope as it has been and is now applied to air pollution work is discussed. A summary of the most common particulate sampling equipment is presented and distinctions as to the area of usage (suspended, or settled particulates) are made in each instance. Actual cases are discussed in which the polarizing microscope was used to determine identities and source of particulate pollutants. Particles from such sources as power plants, feed mills, and combustion sources are discussed and photomicrographs of known samples and unknown particles causing complaints are presented and compared as part of the discussion. References are given which deal with sampling equipment and miscroscopic analysis of various particulates. (Authors' Abs.)

184
Hewson, E. W.
METEOROLOGICAL MEASUREMENTS. In: Analysis, Monitoring and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 329-391.

Meteorological measuring systems and their various components are discussed. The equipment used in primary meteorological measurements (wind direction, wind speed, and wind turbulence) and in secondary meteorological measurements (visibility and turbidity, humidity, precipitation and solar radiation) is described. Other topics discussed are instrument siting, mounting, and protection, processing of meteorological measurements, quality control of meteorological measurements; and instrument requirements.

185
Hinners, R. G., J. K. Burkart, and G. L. Contner.
ANIMAL EXPOSURE CHAMBERS IN AIR POLLUTION STUDIES.
Arch. Environ. Health, v. 13: 609-615, 1966.

The main objectives in the design and construction of an animal inhalation facility are performance and ease of operation. The following requirements were considered mandatory in the design and installation of the animal exposure facility: a source of clean (CBR [chemical biological radiological] filtered) air supply; a constant flow of air; controls to vary air flow over a suitable range; instruments for accurately metering air flow; apparatus for injecting an aerosol or gaseous contaminant into the input air stream; uniform distribution of the input air stream throughout the exposure zone; an air supply cooling system to maintain a constant exposure chamber temperature; despite the animal heat load and variations in ambient temperature; signal devices to indicate failure of operating equipment; provision for exhausting air from the chambers; maintenance of a slight negative pressure to prevent outward leakage from the exposure units; a means of conveniently cleaning the exposure chambers; facilities for taking representative samples of the exposure chamber atmosphere; appropriate sampling ports from which any part of the exposure chamber may be probed; ease of access to exposure chamber interior; suitable observation windows; and automatic control and recording of exposure chamber variables, such as temperature, humidity, and contaminant concentration. (Biol. Abs.)

186
Hinners, R. G., J. K. Burkart, and C. I. Punte.
ANIMAL INHALATION EXPOSURE CHAMBERS. Arch. Environ. Health, v. 16: 194-207, Feb. 1968.

A few of the design considerations which made the square shape of the chamber most practicable were ease of construction and reasonable cost. Pyramidal tops were provided. When the air stream enters at the top and is exhausted near the bottom of the chamber good distribution can be maintained. Mandatory requirements in the design and installation of animal exposure chambers are: (1) A large access door for efficient loading and unloading of animals and cages; (2) Large viewing windows to allow ample light in the chamber and for observation of animals being exposed; (3) Appropriate sampling ports from which representative samples of the chamber atmosphere may be taken; also ports to measure temperature and chamber pressure, and for the automatic wearing device; (4) Interior surfaces of stainless steel or glass to prevent corrosion and facilitate cleaning; (5) A control damper to vary the air flow over a suitable range, and equipment for accurately metering the flow; (6) A constant supply of clean (CBR filtered) air, controlled for temperature and humidity; (7) Apparatus for introducing an aerosol or gaseous contaminant into the input air stream; (8) Maintenance of a slight negative pressure to prevent any leakage outward from the exposure chamber; (9) Signal devices to indicate failure of equipment such as temperature or humidity of air supply, reduction of chamber air supply or exhaust flow, and faulty sealing of chamber door; (10) Control of temperature and humidity in the exposure room to eliminate heat transfer through the walls of the chamber and to avoid shock to the animals when they are removed for examination or chamber cleaning. Compliance with these requirements will help investigators avoid some of the common difficulties and sources of error in their research. (Authors' Abs.)

187

Lockhart, L. B., Jr. and R. L. Patterson, Jr.
EXTENT OF RADIOACTIVE EQUILLIBRIUM BETWEEN RADON AND ITS SHORT-LIVED DAUGHTER PRODUCTS IN THE ATMOSPHERE. Naval Research Lab., Washington, D. C., 1965, 19p. (Report No. NRL-6374)

A set of experimental conditions was derived that optimizes the accuracy with which the Rn content of the atmosphere and its apparent residence time there can be determined from measurement of the filterable gross β-activity during 2 separate 10-minute periods following the end of a 20-minute collection period. The 20-minute collection is made on a filter of essentially 100% retentivity (glass fiber filter) and counted for β-activity through a 10-mil (70 mg/cm^2) Al absorber on equipment of known efficiency for the β-particles emitted by RaB and RaC. The ratio of measured counts during the 61-through-71-minutes decay period to that during the 1-through-11-minutes period is used to obtain the atom ratio of RaC to RaB in the air sampled, the apparent age of the conglomerate of Rn and its daughters, and the total counts to be expected from any given Rn concentration in the air. Extensive exampled of atmospheric measurements are given which suggest that under most conditions in the free atmospheric Rn is essentially at secular equilibrium with its daughter products. Other collections made following addition of Rn to a restricted volume showed the expected increase in the RaC to RaB ratio with time, which confirmed the basic validity of the procedure. (Chem. Abs.)

188

Maga, J. A.

INSTRUMENTATION REQUIREMENTS FOR AUTOMOTIVE EMISSIONS. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, April 28, 1966, Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n.d., p. 13-15.

The main instrumentation needs for automotive emission studies are: (1) Analytical methods to measure the concentration of pollutants discharged, (2) improved sampling methods, (3) accurate laboratory reproduced engine load road conditions, and (4) tests and instrumentation to assure that the control devices on cars continue to work for ten to fifteen years. These problems are presented and enlarged upon.

189

Reiter, R.

APPARATUS AND PROTECTIVE MEASURES AGAINST RADON AND ITS SECONDARY PRODUCTS IN MINE DAMPS. Nukleonik (Heidelberg), v. 9: 359-367, 1967.

An instrument is described that was designed and has been in use for 2 years for underground measurement of airborne radioactivity that arises from Rn in mines. The instrument consists of (1) a centrifugal pump, (2) a d.c. 3.5-kv. corona discharge mechanism, and (3) a halogen front window counter tube mounted in an aluminum case. A wool filter (Material 0982, Firma Schleicher and Schuell) used in this instrument in conjunction with the unipolar negative corona discharge yields 25% separation efficiency that is independent of particle concentration and particle size. A Rn absorbing apparatus that is used for reducing the Rn concentration in mine damps is also described. The absorbing medium is a liquid dispersion of Aerosil in meta or para-tricresyl phosphate (I). The ratio of Rn concentration in I to that in air, was determined to be 4.3 at 20°. (Chem. Abs.)

190

Saltzman, B. E.

AIR QUALITY PROGRAM NEEDS UNIFORM TESTS. Environ. Sci. & Technol., v. 2: 22-32, Jan. 1968.

A review of air pollution analysis methods and instruments determined on the basis of a questionnaire sent to laboratories in the United States and foreign countries are presented. Tables which show continuous monitoring of sulfur, oxidant, hydrocarbons, nitrogen oxides, and carbon monoxide in ambient air. A description of analysis methods with constant-temperature bath, constant boiling liquid, heat sink, and sulfur dioxide permeation tubes are included. (Eng. Index)

191
Saltzman, B. E.
STANDARDIZATION OF METHODS FOR MEASUREMENT OF AIR POLLUTANTS. Jour. Air Poll. Control Assoc., v. 18: 326-329, May 1968.

Currently available compilations of methods of air analysis are listed. Collaborative testing is urgently needed to reconcile differences and to demonstrate the accuracy of these methods. The Analytical Methods Evaluation Service of the National Center for Air Pollution Control conducted a survey of the instruments and manual methods of analysis in use. Responses are tabulated from about 80 laboratories, in 28 states and 3 foreign countries. Sulfur dioxide was the most widely measured pollutant. The first collaborative study organized by the Analytical Methods Evaluation Service is described. The purpose was to evaluate the permeation tube technique as a primary standard method for generating known sulfur dioxide concentrations for instrument calibration and methods testing. Although a good beginning has been made, the testing of methods for measuring air pollutants has barely begun. (Author's Abs.)

192
Saunders, A. W. Jr., R. L. Patterson, Jr. and L. B. Lockhart, Jr.
STANDARDIZATION OF β-COUNTING PROCEDURES USED AT NAVAL RESEARCH LABORATORY IN THE RADIOCHEMICAL ANALYSIS OF AIR FILTER SAMPLES. Naval Research Lab., Washington, D. C., May 1967, 32p. (Rept. No. NRL-MR-1764).

The calibration of β-counting systems used for the quantitative determination of radionuclides in air filter collections is described. Solid calibration standards are prepared from a variety of standardized sources of radioisotopes of different β energies by mounting in a reproducible geometry 50.0-and 25.0-mg. quantities of carrier material containing known amounts of radioactivity. A calibration curve of counting efficiency vs β max. energy is constructed for each counting system, from which the counting efficiency of a wide variety of radionuclides having nonforbidden spectra can be derived. (Chem. Abs.)

193
Wagman, J.
AEROSOL RESEARCH ACTIVITIES AT THE NATIONAL CENTER FOR AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 17: 572-573, Sept. 1967.

Current activities of the National Center for Air Pollution Control reflect a broad range of interests in aerosols as atmospheric pollutants. These interests include the sources, formation, characteristics, and behaviour of atmospheric aerosols, their sampling and analysis, their economic and health effects, and their control. This article examines: (1) Characteristics of aerosols in urban air, (2) Gas-particle interactions, (3) A metal film method for the identification and size analysis of acid aerosol droplets, and (4) Visual and other optical effects of aerosols. (Air Poll. Abs.)

(a) Gases

194
Adams, D. F.
METHODS OF EVALUATION — PHYSICO-CHEMICAL. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, April 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n. d. p. 96-110.

A state of the arts on the analysis of the various by-product, sulfur-containing gases from the kraft pulping process is presented. No method is presented which gives a satisfactory analysis for all five types of sulfur compounds known to be present in the effluent gases (sulfur dioxides, hydrogen sulfide, mercaptans, alkyl sulfides and alkyl disulfides). Only gas chromatography can provide a detailed compound analysis for these complex process gas mixtures.

195
Adams, D. F., W. L. Bamesberger and T. J. Robertson.
ANALYSIS OF SULFUR-CONTAINING GASES IN THE AMBIENT AIR USING SELECTIVE PRE-FILTERS AND A MICROCOULOMETRIC DETECTOR. Jour. Air. Poll. Control Assoc., v. 18: 145-148, Mar. 1968. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967. Paper No. 67-107)

A sulfur-sensitive, coulometric, microtitration cell, originally designed as a gas chromatographic detector, has been converted to direct atmospheric analysis by continuously pumping ambient air through the cell. A method is suggested for sequentially separating H_2S, SO_2, CH_3SH, CH_3SCH_3 and CH_3SSCH_3 in ambient air by using a series of chemically-impregnated membrane filters. Chemical impregnants have been developed which retain one or more of these compounds from mixtures and allow the others to pass quantitatively. Those sulfur compounds remaining in the air stream emerging from each selective filter are then analyzed with the microtitration cell. Air is sequentially sampled through an appropriate series of filters to provide a continuous, step-wise analysis of typical sulfur-containing gases. Over 100 potentially selective formulations were studied. The basis for collection of each type of sulfur-containing gas is discussed. (Authors' Abs.)

196

Adams, D. F., and R. K. Koppe.
DIRECT GLC COULOMETRIC ANALYSIS OF KRAFT MILL GASES. Jour. Air. Poll. Control Assoc., v. 17: 161-165, 1967.

A new bromine, microcoulometric titration cell was used with a commercially-available microcoulometer for the detection and analysis of sulfur-containing gases in various kraft mill emissions. Separation of the constituents of the gaseous mixtures emitted from mill sources including the recovery furnace, digestors, evaporators, lime kiln, and dissolvers was accomplished on an 8-ft, 3/16 in. stainless steel column packed with 10% Triton X-305 on 60-80 mesh Chromosorb G, DMCS [dimethyl dichloro silane]-treated. The column was isothermally operated at 30°C for 4-6 mins. and then rapidly raised to 70°C. The exact program was varied with the type of sample analyzed. Each source gas was initially screened by direct injection of 0.01-0.1 ml of gas to determine whether or not disproportionately large concentrations of one or more components were present. Appropriate sample volumes were then selected to provide "on-scale" recorder peaks for the major constituents. Elution times for the major constituents were observed so that these compounds could be vented at the proper time following injection of large sample volumes (up to 10 ml) for detection and analysis of minor constituents. Venting of the high concentration compounds was necessary when analyzing large volume samples to maintain near equilibrium titration conditions in the microtitration cell. (Authors' Abs.)

197
Brink, D. L., and J. F. Thomas, and D. L. Feuerstein.
MALODOROUS PRODUCTS FROM THE COMBUSTION OF KRAFT BLACK LIQUOR II. ANALYTICAL ASPECTS. TAPPI, v. 50: 276-285, June 1967.

Gaseous and liquid products isolated by pyrolysis of kraft black liquor, were analyzed qualitatively and quantitatively using gas-liquid chromatography with detection by flame ionization. More than 60 components were detected in the pyrolysis liquid and at least 32 of these were present in the pyrolysis gas, even though efficient condensation was carried out at 0°C. Using a microcoulometric titration system, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, dimethyl disulfide, and at least 19 unidentified sulfur-containing components were detected in the pyrolysis products; 17 of the major components were determined quantitatively. Using cochromatography and the methods of detection noted, the identities of methyl mercaptan, dimethyl sulfide, and dimethyl disulfide were verified and tentative identifications of several other sulfur-containing products were also made. Low-boiling organic and inorganic components present in pyrolysis gas were determined independently by gas-solid chromatography with detection by thermal conductivity. Hydrogen, oxygen, nitrogen, methane, carbon monoxide, ethane, carbon dioxide, and acetylene were resolved and determined quantitatively. Hydrogen sulfide, methyl mercaptan, and five unidentified components were also qualitatively detected. Sulfur present in pyrolysis residues was determined using a wet oxidation procedure. The sum of the sulfur contents of the products determined as described, within experimental error, was equal to total sulfur content of the original black liquor. The pyrolysis products contained up to 70% of the total sulfur originally present in black liquor. Changes in the composition of products with changes in the parameters of pyrolysis and combustion were studied. Results indicated that increased emphasis should be placed on the overall combustion process to further control malodorous emissions. (APTIC Abs.)

198
Clemons, C. A., A. I. Coleman, and B. E. Saltzman.
CONCENTRATION AND ULTRASENSITIVE CHROMATOGRAPHIC DETERMINATION OF SULFUR HEXAFLUORIDE FOR APPLICATION TO METEOROLOGICAL TRACING. Environ. Sci. & Technol., v. 2:551-556, 1968.

Dilutions of SF_6 in air can be determined down to a sensitivity of 1 part of SF_6 in 10^{14} parts of air. Samples are concentrated by an adsorption-desorption process with an activated charcoal trap. The desorbed SF_6 is determined by means of gas chromatographic procedure with an electron capture detector. The ultrasensitivity of the method requires that the carrier and sample diluent gases be free of SF_6 and other electron-absorbing impurities. Precautions and methods of avoiding spurious peaks are described. Sample collection and the preparation of calibration mixtures in Saran bags are discussed. Consideration is given to the accuracy of the results as well as typical performance characteristics. Efficiency drops as sample size is increased. Recoveries in excess of 80% are reported for 250-ml. samples. The determination of the distribution of concentrations of SF_6 taken downwind from a release point demonstrates meteorological application over a range of 75 miles. Data were obtained on the atmospheric concentration of SF_6 in residential and urban areas. The analytical technique offers a fast and reliable way to study the transport of pollutants by monitoring the dispersion of an inert gaseous tracer. (Chem. Abs.)

199
Cohen, I. R. and J. J. Bufalini.
THE FERROUS AMMONIUM THIOCYANATE REAGENT FOR OZONE. Environ. Sci. & Technol., v. 1:1014, 1967.

Ferrous ammonium thiocyanate reagent was used for analysis of small amounts of 0_3. The molar absorptivity was approximately constant at 0_3 levels above 2 ppm. (vol./vol.), but increased very rapidly at levels below 0.5 ppm The maximum absorptivity is approximately 30,000 at 0_3 concentrations below 0.1 ppm. Bubbler frit size and collection rate were also important. (Chem. Abs.)

200
Dimitriades, B.
DETERMINATION OF NITROGEN OXIDES IN AUTO EXHAUST. Jour. Air. Poll. Control Assoc., v. 17: 238-243, 1967. (Presented at: 152nd Meeting, Amer. Chem. Soc., New York, Sept. 11-16, 1966)

A new procedure for determining nitrogen oxides in automobile exhaust has been developed. The methods included in the evaluation study are as follows: (1) Static oxidation in tank (ST method) involving oxidation of NO in residence with 0_2 in a stainless steel tank; (2) Bureau of Mines method (BM method involving application of the ST procedure in exhaust samples from which the hydrocarbons have been removed by combustion over catalyst; (3) Chevron Research method (CR method as described in the literature) and (4) Phenoldisulfonic acid method (PDS method as described in the literature). The principal objective of this study was to generate experimental evidence which would lead to defining an optimum procedure for converting NO, present in exhaust gas, into NO_2; this conversion is desired so that the total of NO - NO_2 can be determined quantitatively in the form of NO_2. The results indicated that all four methods are subject to error, the extent of which depends on the conditions employed. The BM method was superior from the standpoint of accuracy because it was less affected by interferences due to hydrocarbon-NO_2 reactions. (Author's Abs., Modified)

201
Edmisten, N. C. and others.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: I INTRODUCTION. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, May 1966, 37 p.

The project was undertaken as a cooperative study of air pollution in the St Louis - East St. Louis metropolitan area with the following broad objectives: (1) to assist the two states and several local agencies to strengthen and coordinate their air pollution activities and control and (2) to augment existing knowledge on the nature and distribution of air pollution and factors affecting prevention and control. The organization of the study and the methods used are described. The various air pollution laws, ordinances and control programs in force in the districts are also described. Records of complaints about air pollution were compiled and are summarized in the report. (Air Poll. Abs.)

202
Fischer, W. H., J. P. Lodge, Jr., A. F. Wartburg, and others.
ESTIMATION OF SOME ATMOSPHERIC TRACE GASES IN ANTARCTICA. Environ. Sci. & Technol., v. 2: 464-466, 1968.

A series of rough measurements of NO_2, SO_2, and aldehydes comprised one phase of a pilot study of the trace chemistry of the Antarctic atmosphere. Compared with similar data obtained by more refined methods in the tropics (Panama), concentrations of NO_2, and SO_2 were near the established limit of roughly 0. 5 ppb., and clearly less than the tropical values. The aldehyde method, in practice, proved insufficiently sensitive to show a difference if one exists. (Chem. Abs.)

203
Hauser, T. R. and D. W. Bradley.
EFFECT OF INTERFERING SUBSTANCES AND PROLONGED SAMPLING ON THE 1, DI-(4-PYRIDYL) ETHYLENE METHOD FOR DETERMINATION OF OZONE IN AIR. Anal. Chem., v. 39:1184-1186, Aug. 1967.

The effect of atmospheric interferences and prolonged air sampling time on the determination of O_3 by reaction with 1, 2-di-(4-pyridyl) ethylene were studied over a 24-hr sampling period. The results demonstrate that there is no loss of collected O_3 from the absorbing solution during a 24-hr sampling period because of an aeration effect. (Public Health Eng. Abs.)

204
Hochheiser, S. and G. A. Rodgers.
EVALUATION OF A VISUAL COLOR COMPARATOR METHOD FOR DETERMINATION OF ATMOSPHERIC NITROGEN DIOXIDE. Environ. Sci. & Technol., v. 1: 75-76, 1967.

Results from the visual color comparator method for determining atmospheric NO_2 deviate 20% from results obtained with a spectrophotometric method. (Chem. Abs.)

205
Hochheiser, S. and J. Santner.
FIELD COMPARISON OF METHODS OF MEASURING ATMOSPHERIC CARBON MONOXIDE. (Presented at: 152nd Meeting Amer. Chem. Soc., New York, Sept. 11-16, 1966).

In urban atmospheric pollution surveys, carbon monoxide concentrations are most commonly determined by a continuous automatic nondispersive infrared absorption method and manually by means of chemically treated silica gel tubes. At present there are no wet chemical reagents known that will effectively remove carbon monoxide from air samples in a single pass through the reagent. This paper is concerned with a field comparison of three methods for determining atmospheric carbon monoxide concentrations, i. e., a continuous, automatic nondispersive infrared absorption method and two modified manual detector tube methods: a length of stain detector tube and a color-changing detector tube. Atmospheric sampling was conducted in several cities using a mobile laboratory. The data obtained with a continuous, automatic nondispersive infrared analyzer were integrated at 30-minute intervals and these data were compared with data obtained by the manual methods during the same time period. When an assortment of methods are used in the conduct of an air pollution survey it becomes important to know the relationship of data produced by the various methods. In general it was found that the infrared absorption method yielded highest CO concentrations, the colorimetric detector tube the lowest and the length of stain detector tube yielded intermediate values. The relationship among methods, however, varied from city to city. (Air Poll. Abs.)

206
Jacobson, J. S.
A CALIBRATION TECHNIQUE FOR ATMOSPHERIC FLUORIDE DETERMINATIONS. (Presented at 153rd Meeting, Amer. Chem. Soc., Miami Beach, Fla., Apr. 10-14, 1967)

Criteria for judging methods for the determination of atmospheric fluorides have not been sufficiently rigorous. As a result, contradictory results and conflicting conclusions have been obtained in investigations concerning public health and the effects of air pollutants on vegetation. It is difficult to evaluate new techniques and modifications of older methods for the quantitative determination of atmospheric fluorides without an accurate dynamic calibration method. Such a technique, based on the molecular diffusion of pure hydrogen fluoride through plastic tubing, has been developed. The accuracy of methods for the determination of atmospheric fluorides can be established using this procedure. The development and conditions of operation as well as the limitations of this calibration procedure will be described. (Air Poll. Abs.)

207
MacLean, D. C., L. H. Weinstein, and R. H. Mandl.
CONTINUOUS MONITORING OF HIGH CONCENTRATIONS OF ATMOSPHERIC FLUORIDE. Contrib. Boyce Thompson Inst., v. 24: 9-10, 1967.

A SO_2 analyzer recorder was adapted to analyze for HF in gas fumigation studies at HF concentrations of 0.5-10 ppm. A calibration curve was obtained by determining the effect of various quantities of HF on the condition of the solution. (1×10^{-5}N H_2SO_4 plus 1×10^{-4}% H_2O_2 in deionized H_2O, vol./vol.) in an all glass detecting cell. The apparatus was adjusted to give readings at intervals of 4 min. (Chem. Abs.)

208
Malanchuk, M.
CONTINUOUS AUTOMATIC DETERMINATION OF SULFUR DIOXIDE IN THE PRESENCE OF AUTO ENGINE EXHAUST.
Amer. Indus. Hyg. Assoc. Jour., v. 28: 76-82, 1967.

Satisfactory continuous automatic monitoring of SO_2 for animal exposure studies was obtained with the Beckman-Acralyzer for NO_x in which a ferric-phenanthroline solution was substituted for the Saltzman solution required for the NO_x determinations. The arrangement is specific for SO_2, but has the 20 min. delay typical of colorimetric methods. At the 1 ppm. level of SO_2, the standard deviation was 3% of the mean value. The linear relationship of the recorder reading to SO_2 concentration 1 ppm. The interferences from NO_x, H_2S, and CO_2 are insignificant in the concentrations of interest. (Chem. Abs.)

209
Mandl, R. H., L. H. Weinstein, J. S. Jacobson, and others.
SIMPLIFIED SEMIAUTOMATED ANALYSIS OF FLUORIDE.
In: 2nd Technicon Symposia, N. Y. and London, 1965.
White Plains, N. Y., Mediad Inc., 1966, p. 270-273.

F,γ quantities, is determined by using an autoanalyzer and a redesigned microdistinction device. The reagents are H_2SO_4 (60 vol. %), Me_2CO, acetate buffer (pH 4.0), 0.01M alizarin-complexon stock solution, and 0.01M $La(NO_3)_3$ solution. The 0.01 M dye solution is made by suspending 0.9634 g. of the dye in 100 ml. H_2O, adding 2 ml. of concentrated NH_4OH and when the dye is dissolved adding 2 ml. of HOAc. The solution is diluted to 250 ml. with H_2O and stored at 4°. Working reagent for 1 day is a mixture of the following (in order): 150 ml. of acetate buffer, 112 ml. of H_2O, 200 ml. of Me_2CO, 18 ml. of 0.01M dye stock solution, 20 ml. of 0.01M $La(NO_3)_3$ solution, 20 drops of Brij 35 wetting agent (30% wt./vol.)). The microdistinction device employs a 15-ft. coil of Teflon tubing in a Pyrex glass reaction kettle containing Primol-355 oil: it is heated by a 500 w. immersion heater and maintains a temperature of 170°. An air stream carries the acidified sample through the coil to the microdistinction column. Fluoride and H_2O distilled from the sample pass to a microcondenser and condensate passes to impinger. The distillate is continuously removed from the impinger at 2.5 ml./min. and the dye reagent is added at 1.69 ml./min. Absorbance is measured at 624 m . A graph shows absorbance of solutions containing from 0 to 100 F/25 ml. of solution. (Chem. Abs.)

210
Meadows, F. L. and W. W. Stalker.
THE EVALUATION OF EFFICIENCY AND VARIABILITY OF SAMPLING FOR ATMOSPHERIC NITROGEN DIOXIDE. Amer. Indus. Hyg. Assoc. Jour., v. 27:559-566, Nov.-Dec. 1966.

A study of the efficiency and variability of the sampling system used to collect nitrogen dioxide in the Alabama Air Pollution and Respiratory Disease Study is described. Experimental sampling was conducted with single and multiple bubblers in series, equipped in each case with either fritted-tip or restricted opening air dispersers. Comparative evaluations of 0.4 to 0.5 1pm and 0.2 to 0.3 1pm air-flow rates indicated that higher collection efficiency, but greater variability, can be expected with lower air-flow rates. Fritted-tip bubblers were found to be more efficient, but restricted-opening bubblers are preferable because their variability is about half that of the fritted-tip bubblers. Sampling variability apparently was not affected by ambient air temperature , humidity, or the concentration of collecting solution used. Collection efficiency, variability, and the method of empirically determining these factors should be specified when reporting ambient atmospheric nitrogen dioxide. (Air Poll. Abs.)

211
Miller, M. E.
A NOTE ON COMPARISON OF STATISTICAL AND ANALYTICAL RESULTS FOR CALCULATING OXIDES OF NITROGEN CONCENTRATIONS. Jour. Air. Poll. Control Assoc., v. 17: 232-234, Apr. 1967.

A question often asked about analytical diffusion models is "How do the analytical results for calculating pollution concentrations compare with those obtained by statistical techniques?" Miller and Holzworth (1967) have developed a simple analytical diffusion model that yields relative pollution concentrations, /Q, as a function of afternoon mixing depth, mean transport wind speed, and city size. This analytical model may also be used in reverse to determine apparent afternoon source strengths from observed afternoon pollution concentrations. The apparent source strengths may then be used with the model on independent data to estimate pollution concentrations. It is the purpose of this note to compare results of calculating average afternoon concentrations of oxides of nitrogen (NO_x) by use of the Miller-Holzworth model with those obtained from statistical regression equations. (Author's Abs.)

212

Nicksic, S. W., and J. H. Harkins.
AMMONIA IN AUTO EXHAUST. Environ. Sci. & Technol., v. 1: 751-752, 1967.

Ammonia in the exhaust from a laboratory V-8 engine was measured to see if the amount was sufficient to account for ambient levels Exhaust samples were cold-trapped from an engine operated at both steady-state conditions and over the California State Motor Vehicle Pollution Control Board traffic cycle. The concentration in the condensate ranged from 1 ppm at idle to 6 ppm at 50 mph road load and averaged 2.2 ppm over the entire traffic cycle The presence of nitrogen-containing detergent additives or lead antiknock compound in the fuel did not affect the amount of exhaust ammonia. On the basis of the data, up to 10% of ammonia in the atmosphere can be accounted for by ammonia discharged from motor vehicles (Authors' Abs.)

213

Pare, J. P.
A NEW TAPE REAGENT FOR THE DETERMINATION OF HYDROGEN SULFIDE IN AIR. Jour. Air Poll. Control Assoc., v. 16: 325-327, 1966.

The lead acetate paper tape reagent method for the estimation of hydrogen sulfide in air has been reviewed with the conclusions that the colored spots on which the quantitative estimation is based are not stable and do not lend by themselves to accurate results. Although it may be retained for grab sampling work, the lead acetate paper type reagent is not acceptable as a stoichiometric reagent in any case where long duration sampling periods are concerned like in air pollution studies. A new mercuric chloride paper tape reagent has been developed as a substitute. Due to the fact that the colored spots resulting from the action of hydrogen sulfide on mercuric chloride are sensitive and very stable this new paper tape reagent is proposed as an adequate and reliable analytical tool for the estimation of hydrogen sulfide in air. Also, a more comprehensive application of the paper tape analytical system is proposed throughout a suitable control of the factor tape retention capacity vs sampling rate which imposes some restrictions in the selection of the practical working range of concentrations. Nevertheless this working range is still wide enough to encompass all the hydrogen sulfide concentrations normally encountered in the city atmosphere. (Author's Abs.)

214
Robbins, R. C., K. M. Borg, and E. Robinson.
CARBON MONOXIDE IN THE ATMOSPHERE. Jour. Air Poll. Control Assoc., v. 18: 106-110, Feb. 1968.

A carbon monoxide analyzer has been developed which is capable of continuous measurement of the carbon monoxide concentration in the atmosphere. The operating principle of the instrument is the reaction of carbon monoxide with hot mercuric oxide followed by the photometric determination of the mercury vapor produced. Oxygenated hydrocarbons and olefins are quantitatively detected. Those normally present are in the ambient atmosphere in low concentrations relative to CO. Hydrogen and methane in the atmosphere do not interfere with the CO analysis. Measurements of atmospheric CO concentrations in California, Greenland, and Oregon seem to indicate that CO content is an air mass characteristic. North Pacific marine air mass concentrations may be as low as about 0.040 parts per milliom (ppm) CO, while the air mass over continental California seems to be characterized by CO levels of 0.5-1.0 ppm or greater. (Authors' Abs.)

215
Singh, T. R., R. F. Sawyer, E. S. Starkman and others.
RAPID CONTINUOUS DETERMINATION IN NITRIC OXIDE CONCENTRATION IN EXHAUST GASES. Jour. Air Poll. Control Assoc., v. 18: 102-105, Feb. 1968.

The rapid determination of nitric oxide levels in exhaust gases is required both for laboratory studies of the exhaust emission characteristics of combustion engines and for routine inspection of motor vehicle exhaust. A continuous sampling, continuous analysis method for measuring nitric oxide has been demonstrated. Rapid oxidation of nitric oxide to nitrogen dioxide is obtained through ozonization. Nitrogen dioxide concentrations are determined by means of an ultraviolet absorption technique. Nitric oxide concentrations between 100 and 5000 ppm have been measured and response time of about 20 seconds obtained. The presence of unburned hydrocarbons in the exhaust sample has an adverse effect on the results of this technique which requires either the removal of hydrocarbons or adjustment of ozone concentration. (Authors' Abs.)

216
Terabe, M., S. Oomichi, F. B. Benson and others.
RELATIONS BETWEEN SULFUR DIOXIDE CONCENTRATION DETERMINED BY THE WEST-GAEKE AND ELECTROCONDUCTIVITY METHODS. Jour. Air Poll. Control Assoc., v. 17: 673-675, Oct. 1967.

Sulfur concentrations in the atmosphere are commonly determined by the West-Gaeke and electroconductive methods. As a part of the United States-Japan Cooperative Air Pollution Measurement Studies, parallel sampling with a 24-hr bubbler, a 1-hr bubbler, and an electroconductive instrument was conducted in Kawasaki, Japan, between Jan. 12 and March 25 and between August 19 and September 30, 1966. These time periods were chosen because of the seasonal variation in the air pollution levels. Fair agreement was obtained between the 24-hr. sample values and the daily mean values of the 24 hourly samples analyzed by the West-Gaeke method. Sulfur dioxide concentrations determined by the electroconductive method were greater than those determined by the West-Gaeke method, particularly in the winter season. Relations between the SO_2 concentrations determined by these 2 methods are discussed. (Chem. Abs.)

217
Trieff, N. M., H. C. Wohlers, J. A. O'Malley and others
APPRAISAL AND MODIFICATION OF WEST-GAEKE METHOD FOR SULFUR DIOXIDE DETERMINATION. Jour. Air Poll. Control Assoc., v. 18:329-331, May 1968.

The West-Gaeke method has been shown to be feasible for detecting changes in SO_2 concentration greater than 10%. Reliable results can be obtained if one makes up stock solutions of the pararosaniline dye from the same powder batch at the same time. Gum arabic stabilizes the SO_2-tetrachloromercurate complex at concentrations of $SO_2 > 8$ g/ml. (Authors' Abs.)

218
Turk, A., S. M. Edmonds, H. L. Mark and others.
SULFUR HEXAFLUORIDE AS GAS-AIR TRACER. Environ. Sci. & Technol., v. 2:44-48, Jan. 1968.

Sulfur hexafluoride is detected by electron-capture analysis in concentrations near 1 ppb. This sensitivity can be enhanced at least 2000-fold by freeze-out concentration. The maximum error in calculating the concentration of the diluted gas mixture is calculated on the basis of the fraction recovered in reconcentration. SF_6 backgrounds in air are undetectable except near leakage sources such as transformers, the use of SF_6 as gas tracer to determine dilution of stack effluent gave results that were close to calculated values. (Eng. Index)

219

Whitby, K. T., B. Y. H. Liu, and A. R. McFarland

A STUDY OF ATOMIZER AEROSOL GENERATORS (INTRODUCTION-SECTION I). Univ. Minnesota, Minneapolis, Dept. of Mechanical Engineering. Progress Report No. AP 00480-2. Aug. 1967, 10 p.

The further development of three generators was attempted. The first of these is an atomizer type generator which is suitable both for polystyrene lastex aerosol generation and for the generation of moderately monodisperse submicron aerosols by the atomization of the dye solutions. The second is a condensation type generator capable of generating high concentrations of monodisperse aerosols from the atomization, evaporation, and recondensation of such substances as DOP, glycerol, and triphenalphosphate. The third generator is an advance version of the Model II spinning disk aerosol generator previously developed. The principal specifications of the generators and the progress to date are reviewed. (APTIC Abs.)

220

Wilson, D. and S. L. Kopczynski.

LABORATORY EXPERIENCES IN ANALYSIS OF NITRIC OXIDE WITH "DICHROMATE" PAPER. Jour. Air Poll. Control Assoc., v. 18: 160-161, Mar. 1968.

The "dichromate" paper developed by Ripley, Clingenpeel, and Hurn was used successfully in our laboratory for conversion of nitric oxide to nitrogen dioxide at concentrations up to the 1 ppm level. When this paper was used for synthetic mixtures with nitric oxide concentrations in the range of 1 -3 ppm, the analyses were erratic and values were lower than calculated. After a number of modifications of the procedures for preparing and using the impregnated paper, a modification of the "dichromate" paper was achieved that reduced scatter in the NO analysis and improved conversion efficiency. The efficiency and reproducibility of the modified paper are good enough that efficiency factors may be established to correct data obtained over a period of at least 6 hours of continuous use at relative humidities (RH) near 50%. (Authors' Abs.)

221
Wohlers, H. C.
RECOMMENDED PROCEDURES FOR MEASURING ODOROUS CONTAMINANTS IN THE FIELD. Jour. Air Poll. Control Assoc., v. 17: 609-613, Sept. 1967.

Although the perception of odorous contaminants cannot be precisely described, certain basic facts about human olfaction are known. With known facts or principles, it is possible to investigate odorous contaminants for air pollution control purposes. Odor remains, however, a very intangible commodity. Odorous contaminant investigations must be tailored to the individual problem or locality. Consequently, the methods described were designed for individuals who have working knowledge of either odor or air pollution problems. Background references are available for workers who are not familiar with either field. Generalized facts concerning odors as well as subjective and objective methods for measuring odorous contaminants in the field are described. The use of specific portions of the method depends upon each individual investigation. (APTIC Abs.)

(b) Particulates

222
Blanchard, R. L.
RAPID DETERMINATION OF LEAD-210 AND POLONIUM-210 IN ENVIRONMENTAL SAMPLES BY DEPOSITION ON NICKEL. Anal. Chem., v. 38: 189-192, 1966.

A procedure for determining ^{210}Po and ^{210}Pb simultaneously in environmental samples was developed by finding the optimum conditions for the spontaneous deposition of ^{210}Po and ^{210}Bi on nickel from HC1 solution. The effects of HC1 concentration, temperature, time of deposition, surface of the planchet, and the presence of the $HC10_4$ used to ensure oxidation of environmental samples were studied. Recoveries of ^{210}Po, ^{210}Bi, and ^{210}Pb were determined for various environmental samples spiked with a ^{210}Po-^{210}Bi-^{210}Pb standard. The average efficiences for the deposition of ^{210}Po and ^{210}Bi were 96±4 and 96±3%. The average efficiency for the deposition of ^{210}Pb determined by the decay measurement was 13 + 2%. The ^{210}Po concentration was determined by alpha counting. The ^{210}Pb concentration was determined by beta counting the ^{210}Bi daughter. The aluminum absorber was used to eliminate the ^{210}Po alpha and ^{210}Pb beta particles. Among the materials analyzed were potatoes, radishes, carrots, lettuce, cabbage, whole wheat, well water, bone ash, and beef tissue. (Biol. Abs.)

223
DeMaio, L. and M. Corn.
POLYNUCLEAR AROMATIC HYDROCARBONS ASSOCIATED WITH PARTICULATES IN PITTSBURGH AIR. Jour. Air Poll. Control Assoc., v. 16: 67-71, 1966.

Pittsburgh air was sampled continuously at one site for 336 hr. sample at 45 cfm with a high volume sampler equipped with a horizontal elutriator as a first stage of separation, and an MSA 1106B glass fiber filter as a final particulate collection stage. The horizontal elutriator was designed to simulate the particulate deposition characteristics of the human respiratory tract. Samples were collected during the period June 1964 to February 1965. Respirable and non-respirable particulate samples were analyzed for polynuclear aromatic hydrocarbon content by a new technique which utilized dual column, flame ionization gas chromatography. It was possible to quantitatively analyze a concentrated benzene extract of the particulate sample for the following individual components: 1, 2 benzanthracene; chrysene; pyrene; 3, 4 benzofloranthene; 1, 2 benzoperylene. It was not possible to distinguish between 3, 4 benzopyrene, 1, 2 benzopyrene and perylene; only the total quantity of these compounds present was detected. This analytical technique is comparable in sensitivity to formerly reported, more time-consuming methods and is very rapid, requiring less than one hour to perform after benzene extraction. Amounts of the above compounds associated with the 2 particulate fractions collected are reported and discussed. (Biol. Abs.)

224
Epstein, S. S.
TWO SENSITIVE TESTS FOR CARCINOGENS IN THE AIR. Jour. Air Poll. Control Assoc., v. 16: 545-546, Oct. 1966.

A photodynamic bioassay for polycyclic atmospheric pollutants, measured with Paramecium caudatum and based on the previous demonstration of a positive and significant association between high photodynamic activity and carcinogenicity in a large series of polycyclics, has been developed in an attempt to provide a simple and rapid, but presumptive, indirect index of carcinogenicity attributable to polycyclic compounds. Additionally, the carcinogenicity of organic extracts of atmospheric pollutants has been directly measured with newborn mice, based on the well-known enhanced response of neonates to a variety of defined chemical carcinogens. Current correlative evaluation with chemical and other data indicates the practical utility of both assays for carcinogenic air pollutants. (APCA Abs.)

225
Epstein, S. S., S. Joshi, J. Andrea and others.
CARNOCINOGENICITY OF ORGANIC PARTICULATE POLLUTANTS IN URBAN AIR AFTER ADMINISTRATION OF TRACE QUANTITIES TO NEONATAL MICE. Nature (London), v. 212: 1305-1307, Dec. 1966.

A photodynamic bioassay was developed as an indirect index of the carcinogenicity of polycyclic compounds, in order to permit rapid and large scale screening of organic atmospheric pollutants. The assay has been applied to benzene-soluble organic extracts of particulate atmospheric pollutants, and also to six fractions thereof, obtained from more than a hundred different sources in the United States, comprising a wide range of urban and rural pollutants. The present article describes the development of another bioassay that uses neonatal mice in a highly sensitive and direct estimation of carcinogenicity as a result of all components in organic extracts of particulate pollutants. (Air Poll. Abs.)

226
Gruber, C. W. and C. E. Schumann.
SOILING POTENTIAL. A NEW METHOD FOR MEASURING SMOKE EMISSION. Jour. Air Poll. Control Assoc., v. 16: 272-275, 1966.

There is a growing interest in effects of sub-micron, nonsettling particles in the atmosphere among air pollution control agencies throughout the country. This type of pollution, generally referred to as the "soiling index" of the atmosphere, is produced primarily by the incomplete combustion of fuels. The measurement procedure has been fairly well standardized, the values being reported as Cohs or Ruds per 1000 linear feet of air. Using a similar technique, a method of quantitating smoke emission in objective terms first demonstrated by W. C. L. Hemeon in 1953, has been applied to source testing at several operating plants by the Cincinnati Division of Air Pollution Control. The source strength will be called "soiling potential" while the effect in the general atmosphere is termed "soiling index". The soiling potential unit is Rud-ft.^{2} per cubic foot exhaust gases or Rud-ft.^{2} per unit of fuel input. The "Soiling Potential" sampler is described and results of tests are given. Included is the use of soiling potential in quantitating smoke emission from single sources and for constructing area wide inventory of smoke emission. The use of an area wide smoke emission inventory in Rud-ft.^{2} in a simple diffusion model for calculating the soiling index (Rud-ft.^{2} per 1000 cu ft.) in the general atmosphere at a given point is explored. (Authors' Abs.)

227
Halitsky, J.
METHOD FOR ESTIMATING CONCENTRATIONS IN TRANSVERSE JET PLUMES. Air and Water Poll.; Internat. Jour., v. 10: 821-843, 1966.

The available data on transverse jets was assembled and fitted into a simple mathematical diffusion model. The matching of the transverse jet plume to the simple plume leads to a rational method for estimating the virtual source location. Since all of the test data were obtained in low-turbulence wind tunnels, the empirical expressions selected to fit the data are not strictly applicable to jets in a natural wind. The model, therefore, should be considered as a 1st approximation, to be modified as field data become available. Isothermal conditions are assumed, but it is thought that the major change to be expected for heated jets is in the curvature of the centerline, a subject which is not treated in detail in the paper. The model provides for extensions of the plume beyond the transverse jet region. (Chem. Abs.)

228
Hashimoto, Y and J. W. Winchester.
SELENIUM IN ATMOSPHERE. Environ. Sci. & Technol., v. 1: 338-340, Apr. 1967.

The determinations of atmospheric selenium by neutron activation in 22 samples of snow and rain collected during 1964-1965 winter and in seven air samples collected during following spring in Cambridge, Mass. are discussed. Sulfate was determined gravimetrically or turbidimetrically in most samples. Selenium concentration averaged 0.2 μg/liter of water or per 200 cu m of air, and the average value of weight ratio Se/S equals 1×10^{-4}. Approximately the same ratio is commonly found in igneous and sedimentary rocks, sulfide ores, and fossil fuels, but seawater ratio is one thousandth as large. This information implies a mainly terrestrial, including pollution, source for selenium as well as sulfur in the atmosphere of the city of Cambridge. (Eng. Index)

229
Klosterman, D. L. and J. E. Sigsby, Jr.
APPLICATION OF SUBTRACTIVE TECHNIQUES TO THE ANALYSIS OF AUTOMOTIVE EXHAUST. Environ. Sci. & Technol., v. 1: 309-314, 1967.

A simple system, developed for chemical class analysis of hydrocarbons found in automotive exhaust should prove useful for evaluating the contributions of automotive emissions to photochemical air pollution. The system of scrubbers permits determination of paraffins, olefins and acetylenes, and aromatics. Benzene may be determined with either the paraffinic or aromatic hydrocarbons. The system may be used with existing standard hydrocarbon analyzers without requiring their modification. (Authors' Abs.)

230
Nicksic, S. W., J. Harkins, and P. K. Mueller.
SOME ANALYSES FOR PAN AND STUDIES OF ITS STRUCTURE. Atmos. Environ., v. 1: 11-18, Jan. 1967.

Methods of alkaline hydrolysis, nuclear magnetic resonance, and neutron activation analysis were used for measuring the amount of PAN (peroxyacetylnitrate) in synthetic preparations for oxygen content. Samples of PAN were prepared by photolysis of ethyl nitrite in oxygen and purified by gas chromatography. The irradiation system was a 10-liter pyrex channel surrounded by four 122 cm long UV fluorescent tubes which emitted most of their energy between 3200 and 3800 A. The residence time of the recirculating gas mixture was 10 min. The purified compound was stored in specially constructed and cleaned 39-liter stainless steel tanks at pressures up to 7 atm. (Eng. Index)

231
Pueschel, R.
THE USE OF 1-(2-PYRIDYLAZO)-2-NAPHTHOL (PAN) IN TRACE ANALYSIS. Zeitschrift für analytische Chemie (Wiesbaden), v. 221: 132-134, 1966.

The conditions for the reaction of PAN with $VO_2{}^+$, Mn^{2+}, Fe^{3+}, Co^{3+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, Cd^{2+}, Hg^{2+}, Ga^{2+}, In^{3+}, and Tl^{3+} are systematically discussed. (Chem. Abs.)

232
Purcell, T. C. and I. R. Cohen.
MICRODETERMINATION OF PEROXIDES BY KINETIC COLORIMETRY. Environ. Sci. & Technol., v. 1: 431-433, 1967.

Peroxidic compounds occur in polluted air and contribute, at least in part, some of the deleterious effects on plants and animals. When ferrous thiocyanate, neutral potassium iodide, and molybdate-catalyzed potassium iodide reagents are used for the analysis of microgram quantities of a variety of peroxidic compounds by the method of kinetic colorimetry the following occur: ozone and peracetic acid give an immediate maximum color development with all 3 reagents; hydrogen peroxide gives slow color development with neutral KI only; and acetyl peroxide, nitrogen dioxide, alkyl hydroperoxides and peroxyacylnitrates give slow color development with all 3 reagents. The half-lives of these colorimetric reactions serve to identify specific oxidants. (Authors' Abs.)

233
Rayner, H. B., F. E. Murray, and I. H. Williams.
STUDIES ON THE GAS-CHROMATOGRAPHIC ANALYSIS OF KRAFT MILL SULFIDES. II. DETERMINATION OF MICROGRAM QUANTITIES OF METHYL MERCAPTAN, METHYL SULFIDE, AND METHYL DISULFIDE IN AQUEOUS SOLUTION. Pulp and Paper Magazine of Canada (Gardenvale, Que.), v. 68: T301-T304, 1967.

An apparatus was devised for stripping MeSH, Me_2S, or Me_2S_2 present in microgram quantities in aqueous solution. Chromatography was then used for the analysis. The precision of the method was within 5% and as little as 0.01 ppm of these materials in aqueous solution could be determined. (Chem. Abs.)

234
Sawicki, E. and R. A. Carnes.
FLUORIMETRIC ASSAY FOR α-GLYCOLIC COMPOUNDS AND OTHER ALDEHYDE PRECURSORS. Mikrochimica Acta (Wien), v. 3: 602-607, 1968.

Alpha-glycolic and olefinic compounds can be determined by controlled oxidation to aldehydes, which are subsequently analyzed with J-acid (2-amino-5-naphthol-7-sulfonic acid), 2,4-pentanedione (I), or dimedone (II). Add 0.2 ml of 0.5% HIO_4 in 1:280 $H_2SO_4-H_2O$ to the α-glycolic compound solution (0.5 ml for J-acid or 1 ml for I or II determinations). After 15 minutes add 0.4 ml 2% $NaAsO_2$ in 5% HCl. To determine with J-acid, wait two minutes, add 5 ml of 0.01% J-acid in H_2SO_4, and, after 15 minutes dilute to 10 ml with H_2SO_4. To determine with I, after two minutes, add 2 ml of solution containing 15 g NH_4OAc + 0.2 ml I + 0.3 ml HOAc/100 ml and heat 10 minutes at 57°. To determine with II, wait two minutes, then add 2 ml of solution containing 25g NH_4OAc + 0.3g II + 0.4 ml HOAc/100 ml and heat 10 minutes at 100°. To determine olefins, add 0.1 ml of aqueous $KMnO_4$ to 0.5 ml of olefin solution (in HOAc for H_2O-insoluble olefins). After one minute add 0.5 ml of 0.02 M $NaIO_4$. After 10 minutes add 0.5 ml of 1.5 M $NaAsO_2$, 0.5 ml of 2N H_2SO_4, and 5 ml of 0.01% J-acid in H_2SO_4 consecutively. Allow a 15-minute reaction time before diluting to 10 ml with H_2SO_4. I and II were unsatisfactory for the olefin determinations. Results are tabulated for the assays of 15 α-glycolic compounds, 11 polar olefins, and 14 H_2O insoluble formaldehyde precursors. Also compounds analyzed, reagent, excitation wavelength (mμ), emission wavelength (mμ), blank value (μg), relative standard deviation (%), Beer's law range (μg), were: 2-deoxyribose, J-acid, 461, 518, 1.8, 4.86, 0.5-11; 2-deoxyribose, I, 405, 510, 0.7, 3.45, 1.5-58; 2-deoxyribose, II, 392, 462, 9.4, 9.1, 0.4-6.8; acrylic acid, J-acid, 462, 518, 0.5, 4.0, 0.5-7; 1-hexane, J-acid, 464, 518, 0.8, 4.86, 0.8-17. (Chem. Abs.)

235
Sawicki, E. and C. R. Engel.
COLORIMETRIC DETERMINATION OF FURFURAL AND ITS PRECURSORS WITH AZULENE. APPLICATION TO AIR POLLUTION. Analytica Chimica Acta (Amsterdam), v. 38:.315-320, 1967.

Two procedures in which azulene is used as the reagent for the determination of furfurals and furfurals and their carbohydrate precursors are described. Aliphatic aldehydes, alcohols, and 2-deoxy sugars and their derivatives gave weak to negative reactions. The methods have been applied to the estimation of furfurals and furfural-precursor carbohydrates in effluent from a coffee-roasting industrial plant. (Authors' Abs.)

236
Sawicki, E. and C. R. Engel.
DETERMINATION OF 2-AMINO-3-HYDROXY ACIDS AND ANALOGOUS COMPOUNDS CONTAINING 2-EMINOETHANOL OR ETHYLENEDIAMINE STRUCTURES. Chemist-Analyst, v. 56: 7-8, 1967.

Two-amino-3-hydroxy acids and compounds containing 2-aminoethanol (I) or $(CH_2NH_2)_2$ (II) groups were determined photochemically. The determination was based on a IO_4^- oxidation followed by reaction of the resulting aldehydes with 3-methyl-2-benzothiazolinone hydrazone (III). Add 1 ml 0.02M aqueous $NaIO_4$ solution to 0.5 ml aqueous sample solution, mixture and allow to stand 10 minutes. Add 1 ml 1.5M $NaAsO_2$, then 1 ml M H_2SO_4 and 1 ml 0.8% aqueous III. HC1 solution. Heat 3 minutes on a boiling water bath then cool to room temperature. Add 2 ml 0.5% aqueous $FeCl_3$ solution and allow to stand 15 minutes. Measure absorbance at 629 mμ vs a blank. Beer's law was followed for 0.53-5.5 γ serine. The standard deviation for 12 determinations was ±1.39%. Molar absorptivities are reported for 15 compounds. Negative results were obtained for O- and N, N-disubstituted derivitives of I and II. Tryptophan and piperazine gave weak reactions. N-Acyl substituents can interfere, as well as aromatic amines and compounds containing an α-glycol group. (Chem. Abs.)

237
Sawicki, E., C. R. Engel, and W. C. Elbert
CHROMATOGRAPHIC LOCATION AND COLORIMETRIC DETERMINATION OF MERCAPTANS, PROLINES, AND FREE RADICAL PRECURSORS. Talanta (Oxford), v. 14: 1169-1178, 1967.

A new reagent, 7,7,8,8-tetracyanoquinodimethan (TCNQ), is introduced for the colorimetric determination of free radical precursors, such as cysteine, proline, hydroxyproline, the phenoxazine family, and mercaptans. TCNQ is also useful in the location and characterization on paper or thin-layer chromatograms of proline, hydroxyproline, cysteine, polynuclear compounds, mercaptans, thiocarbonyl, amides, and thiosemicarbazones. In addition, aminoacid derivatives, such as the N-(phenylthiocarbamoyl) amino acids and the 3-phenylthiodantoins, can be located and characterized on chromatograms. TCNQ has been applied to the location and characterization of atmospheric proline, carbazole, and 11 H-benzo[a]carbazole. For characterization purposes absorption spectra were obtained directly from glass-fiber paper, or thin-layer chromatograms from ~300-900 mμ. (Chem. Abs.)

238
Sawicki, E. and J. Pfaff.
ANALYSIS OF COMPOUNDS CONTAINING THE P-NITROANILINE PHOSPHOR AND ANALOGOUS GROUPS BY PHOSPHORIMETRY AND BY ROOM-TEMPERATURE AND LOW-TEMPERATURE FLUORIMETRY. Microchem. Jour., v. 12: 7-25, 1967.

An investigation of the phosphorimetric and room temperature and low temperature (liquid N) fluorimetric properties of a number of aldehyde and ketone 4-nitrophenylhydrazones (I) establishes the value of 4-nitrophenylhydrazine in low temperature fluorimetric trace analysis. At room temperature most aliphatic carbonyl I are nonfluorescent but strongly phosphorescent while the aromatic derivatives, in solvents of low dielectric constant, are nonphosphorescent but strongly fluorescent. At liquid N temperatures aromatic I are highly fluorescent in all solvents. Some compounds are fluorescent at liquid N temperatures but neither fluorescent nor phosphorescent at room temperature. In trace analysis research phosphorimetry and low temperature and room temperature fluorimetry are more valuable when used together than when used singly. (Chem. Abs.)

239
Sawicki, E., R. Schumacher, and C. R. Engel
COMPARISON OF 3-METHYL-2-BENZOTHIAZOLINONE HYDRAZONE (MBTH) AND OTHER METHODS FOR THE DETERMINATION OF SUGARS AND OTHER α-GLYCOLIC DERIVATIVES. APPLICATION TO AIR POLLUTION. Microchem. Jour., v. 12: 377-395, 1967.

The method of Bartos for the determination of sugars with 3-methyl-2-benzothiazolinone hydrazone was applied to aqueous extracts of atmospheric dust and its periodic acid cleavage products in an investigation of the possible contribution of carbohydrates to airborne allergens. The results were interpreted as showing 9 to 40 mg. α-glycolic compound/g. particulate sample or 2 to 7 μg./m.^{3} air collected over several U.S. cities in 1965 and 1966. The MBTH method was applied to a long list of carbohydrates and polyols. Several comparisons were made with methods based on chromotropic acid, pyrogallol, orcinol, and azulene. (Chem. Abs.)

240
Sawicki, E., T. W. Stanley, and W. C. Elbert
ASSAY FOR 9-ACRIDANONE IN URBAN ATMOSPHERE BY THIN-LAYER CHROMATOGRAPHY FLUORIMETRIC PROCEDURES. Talanta (Oxford), v. 14: 431-434, 1967.

9-Acridanone was found in urban atmospheres. Four 2-dimensional thin-layer chromatographic methods were described for the assay of this compound in urban atmospheres and in air pollution source effluents. Fluorimetric assay was done either directly on the plate or after elution. The best method involved 2-dimensional separation on alumina-cellulose followed by elution and fluorimetric/analysis of the acidic MeOH solution. Urban atmospheres contain approximately 0.4 mg. of 9-acridanone/m.^{3} of air. (Chem. Abs.)

241
Sawicki, E., T. W. Stanley, and W. C. Elbert.
COMPARISON OF FLUORIMETRIC METHODS OF ASSAY FOR BENZ[C]ACRIDINE AND BENZO[H]QUINOLINE IN URBAN ATMOSPHERE AND AIR POLLUTION SOURCE EFFLUENTS. Jour. Chromatog., v. 26: 72-78, 1967.

Five methods for estimating benz[c]acridine (I) and 3 for estimating benzo[h]quinoline (II) in urban atmospheric samples are compared and a procedure is recommended for each. For I, extract sample 6 hours with 1:4 $Et_2NH:C_6H_6$ in a Soxhlet extractor, then evaporate the solvent under vacuum. Dissolve the residue in CH_2Cl_2 (100 μl. solvent/5 mg. residue) and chromatograph on a thin-layer of alumina in 19:1 $C_5H_{12}:Et_2O$. Extract the I spot with 5 ml of 10% HCl, neutralize with Na_2CO_3, and extract with 3 5-ml. vols. of CH_2Cl_2. Evaporate the solution and dissolve the residue in 50:1 C_5H_{12}:trifluoroacetic acid. Estimate I spectrofluorimetrically with 288 and 472 mμ as the excitation and emission wavelengths, respectively. II can be estimated similarly to I, except that II is separated on a 2:1 alumina:cellulose thin-layer developed 1st with 19:1 $C_5H_{12}:Et_2O$, then with a 35% aqueous dimethylformamide solution. Also, the excitation and emission wavelengths for II are 272 and 420 mμ, respectively. The detonation limit was 40 ng./ml. for both I and II. The procedure of S., et al, is recommended for obtaining the most information about the basic pollutants in urban atmosphere samples. (Chem. Abs.)

242
Sigsby, J. E. and D. L. Klosterman
APPLICATION OF THE 3 MBTH ALDEHYDE ANALYSIS TO AUTOMOTIVE EMISSIONS. (Presented at: 153rd meeting, Amer. Chem. Soc., Miami Beach, Fla., Apr. 10-14, 1967.)

As the evaluation of the hydrocarbon portion of the automotive emissions becomes more routine, interest is increased in the analysis of other products of combustion. Consideration of these other products is important in evaluating the applicability of exhaust control devices. The application of the convenient 3 MBTH aldehyde analysis is dependent upon control of numerous sampling parameters. Temperature of sample lines and collection media may be critical. In our proposed method, sensitivity of higher aldehydes is increased by the addition of methanol to the collection media. Interferences and the approximations used in general analysis are briefly discussed. (Air Poll. Abs.)

243
Sigsby, J. E. and A. H. Rose
EVALUATION OF A SUBTRACTIVE METHOD IN AUTO EXHAUST ANALYSIS. (Presented at: 152nd meeting, Amer. Chem. Soc., New York, Sept. 11-16, 1966.)

A rapid and convenient method for analyzing automotive exhaust hydrocarbons by chemical class is needed for routine determination of photochemical reactivity of the exhaust. A subtractive technique has been described for separating exhaust into three classes: paraffins plus benzene, olefins and acetylene, and aromatics less benzene. This technique has since been applied to over 100 separate samples of exhaust for which "complete" gas chromatographic analyses also were obtained. The gas chromatographic analyses included one- through eight-carbon paraffins and cycloparaffins, two- through six-carbon olefins, acetylene, and six-through ten-carbon aromatics. The gas chromatographic results are summarized by appropriate classes and compared with results obtained by the subtractive technique. Data from this study and a previous study allow comparisons of some relative product concentrations. The subtractive system used is described in some detail as are evaluations of operating characteristics. (Air Poll. Abs.)

244
Smith, D. S., R. F. Sawyer, and E. S. Starkman
OXIDES OF NITROGEN FROM GAS TURBINES. Jour. Air Poll. Control Assoc., v. 18: 30-35, Jan. 1968. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967.)

Experimental and theoretical studies were made to provide information on nitrogen oxide concentrations produced by gas turbine engines. Nitric oxide concentrations of from 100 to 350 ppm, adjusted to stoichiometric conditions, were measured in aircraft turbojet engines. Concentrations of less than 50 ppm, similarly adjusted, were measured in a 60 hp industrial gas turbine. Concentrations of about 100 ppm, also adjusted, were measured in a laboratory combustor of a design similar to gas turbine combustors. Carbon monoxide and unburned hydrocarbon concentrations also were determined. Comparison with predicted equilibrium concentrations shows strong departures from equilibrium. (Authors' Abs.)

245
Stanley, T. W., J. E. Meeker, and M. J. Morgan
EXTRACTION OF ORGANICS FROM AIRBORNE PARTICULATES: EFFECTS OF VARIOUS SOLVENTS AND CONDITIONS ON THE RECOVERY OF BENZO(A)PYRENE, BEN(C)ACRIDINE, AND 7H-BENZ(DE)ANTHRACEN-7-ONE. Environ. Sci. and Technol., v. 1: 927-931, Nov. 1967. (Presented at: 153rd meeting Amer. Chem. Soc., Miami, Fla., Apr. 9-14, 1967.)

Recently developed spectrophotometric and spectrophotofluorimetric methods of analysis for several known carcinogens were applied in studies of extraction efficiencies of solvent systems used to obtain the organic fractions of airborne particulates. Some of the solvents investigated were pentane, benzene, cyclohexane, acetone, diethyl ether, methylene chloride, and benzene: diethylamine (4:1, V/V). Weights of organic extracts from known weights of carefully composited air particulates ranged from 20 to 1300 mg. Variations of time, temperature, and method of extraction affect total weights of organic extracts and concentrations. In the analysis of equal weights of air particulates enriched with pure benzo(a)-pyrene, benz(c)acridine, and 7H-benz(de)anthracen-7-one the percentages of these compounds extracted ranged from 50 to 100, 15 to 100, and 40 to 80, respectively. On the basis of these data extraction efficiency studies are required for the proper selection of solvents used to define the organic extracts of airborne particulates. (Authors' Abs.)

246
Stanley, T. W., M. J. Morgan, and J. E. Meeker.
THIN LAYER CHROMATOGRAPHIC SEPARATION AND SPECTROPHOTOMETRIC DETERMINATION OF BENZO[α]PYRENE IN ORGANIC EXTRACTS OF AIRBORNE PARTICULATES. Anal. Chem., v. 39: 1327-1329, 1967.

The procedure of Sawicki, et al. for the determination of benzo[α]-pyrene (I) in organic extracts of airborne particulates by thin-layer chromatography and spectrophotometry or spectrophotofluorimetry is modified for the routine separation and spectrophotometric determination of I. I is separated from a 0.5-5 mg. aliquot of a CH_2Cl_2 solution of organic residue of air particulates on activated Al_2O_3 thin layers. The spots on the developed chromatogram are visualized by exposure to a 3600-A. light source. I is eluted from the adsorbent by mixing for 3 minutes with 10 ml. anhydrous Et_2O. The adsorbent is washed under vacuum at 50°, at a rate approximately equal to the evaporation rate until 100 ml. Et_2O is used. The residue is dissolved in pentane. The solution is then evaporated to 1 ml. and the absorbance is measured at 375, 382, and 390 mμ. The amount of I present is calculated by the base line method by using values obtained for a 2-mg. amount of pure I eluted from the same thin-layer plate. The elution is 95.5% efficient for pure I. A mean I concentration of 546 mg./g extract and ± 7% relative standard deviation is obtained from the analysis of a composite extract of urban particulates. (Chem. Abs.)

247
Wartburg, A. F. and J. P. Lodge, Jr.
ESTIMATING CONCENTRATION OF AIR POLLUTANTS.
Chemistry, v. 41: 29-32, 1968.

Two methods for estimating atmospheric SO_2 and oxidants and a method for determination of atmospheric particulate matter were described. Air is drawn through a filter paper held in a homemade or commercial holder and passed through an impinger containing a standard starch-I solution until the solution is clear for determination of the SO_2 concentration. Air is passed through a KI-H_2O-starch-$Na_2S_2O_3$ solution to produce a blue colored end point to determine the oxidant. Particulate matter can be determined by drawing air through only the filter paper until a darkening is observed on the paper, and a qualitative estimation of pollution related to the time of collection can be made. Connection to a vacuum pump is made from the impinger with rubber tubing and a 22 gage hypodermic needle inserted into the vacuum line is used as an orifice to maintain a known flow rate. Methods for calculating results are given and accuracies expressed in ppm. are attainable. (Chem. Abs.)

248
West, P. W.
CHEMICAL ANALYSIS OF INORGANIC PARTICULATE POLLUTANTS. In: Air Pollution. v. II: Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 147-185.

Special selected methods and certain basic determinations of inorganic particulate pollutants are presented. Considerable emphasis is placed on atomic absorption and ring oven methods because they are new and applicable to the study of airborne particulates. They are specific, sensitive, convenient, and generally reliable. A table giving a general summary of the various analytical methods now used in studying inorganic particulates in included.

249
West, P. W.
THE IDENTIFICATION AND DETERMINATION OF AIRBORNE PARTICULATES BY MEANS OF THE RING OVEN TECHNIQUE.
Jour. Air Poll. Control Assoc., v. 16: 601-605, Nov. 1966.

The ring oven technique was first introduced as a means for conducting separations and concentrations on filter paper for final spot test analysis. By means of the technique, a complete qualitative scheme of separation and analysis can be made on a single drop of unknown. Recently, the effectiveness of the ring oven as a tool for quantitative analysis has been recognized. The method is particularly attractive for studies of airborne particulates. Samples of airborne particulates can be collected by high volume samplers, tape samplers, electrostatic precipitators, or by other appropriate means. The samples may be put into solution and an aliquot added to filter paper on a ring oven and washed to the ring zone for final identification and estimation. Any necessary separations can normally be carried out during the ring oven operations. A convenient approach for most studies is to collect the samples on tapes and carry out the necessary dissolution, separation, identification, and estimation steps directly on the tape itself. The ring oven methods are usually selective or even specific. The method applies to the microgram to nanogram range and the accuracies are comparable with those obtained by emission spectroscopy, polarography, fluorimetry, and spectrophotometry. (Author's Abs.)

250
West, P. W. and L. R. M. Pitombo
MICRODETERMINATION OF COPPER USING DITHIOOXAMIDE CRAYONS AND THE RING-OVEN TECHNIQUE. Analytica Chimica Acta (Amsterdam), v. 37: 374-378, 1967.

Cu, 0.1-0.5 γ, is determined in dust and air particulate samples by using a dithiooxamide (I) crayon and the ring-oven method of Weisz. Prepare the I crayon by mixing 3.5 g. of monoglyceryl stearate and 1.5 g. of paraffin in a water bath at 90°, add 25 mg. of I (dissolved in 4 drops of Me_2SO), homogenize the mixture, draw the melt into a paper straw, and allow to cool. Place a Munktells No. 00 (5.5 mm. diam.) or Whatman No. 41 filter paper, with the center marked with a pencil dot, on a ring-oven at 90-5°. Add 10 μl. of malonic acid-NaOH buffer solution. (pH 4.0), followed by 6 10-μl. volumes of 0.05 N HCl. After completing the transfer to the ring zone, and the paper is almost dry, remove it from the ring oven, and allow to dry in a stream of cool air (avoid overdrying). Rub the ring zone with the I crayon, and expose to H_2O (70 - 80°) for a few seconds to give contact of the I with the sample. Dip the filter paper in $CHCl_3$ for 5 minutes, dry in a stream of cool air, and dip again in H_2O for 3 minutes; press between 2 filter papers and dry in a stream of cool air. The color intensity of the rings is stable for ≥ 1 month. Prepare a standard scale by the above method by making rings with 5-40 μl. vols. of a solution containing 0.01γ Cu^{2+}/μl. If sequential tape samplers are used, select an instrument with an orifice of < 2.2 cm., so that the total sample can be centered on the ring oven without the spot extending to the ring area. Dissolve the Cu by treatment with diluted HNO_3, wash the dissolved salts to the ring zone, and estimate Cu as described above. The recoveries of 0.2 and 0.3 γCu^{2+}, based on averaging 5 values calculated from 3 rings each, are 0.197 ± 0.013, and 0.296 ± 0.015 γ, respectively. The limit of detection is 0.04 γ Cu^{2+}. (Chem. Abs., Modified)

251
West, P. W. and Sachdev, S. L.
THE STUDY OF AIR BORN PARTICULATES BY MEANS OF RING OVEN TECHNIQUES. (Presented at: 153rd meeting, Amer. Chem. Soc., Miami Beach, Fla., Apr. 10-14, 1967.)

The ring oven technique is ideally suited for the separation, identification and determination of air born particulates. Methods are available that are remarkably reliable and which have sensitivities in the microgram to manogram range. Ring oven studies may be carried out on samples collected by means of fallout jars, electrostatic precipitators, impactors, high volume samples, or sequential teak samplers. The samples are put into solutions by appropriate means and then transferred and concentrated by means of suitable operations on the ring oven. Selective or specific spot test reactions are then used to complete the study. Sensitivities in the microgram to manogram range are obtained. The ring oven methods are remarkably simple and rapid. The equipment can be purchased from $100 to $200, or the company shop made from readily available material for a few dollars. (Air Poll. Abs.)

(c) Chromatography

252
Barber, E. D. and E. Sawicki.
SEPARATION AND IDENTIFICATION OF AROMATIC CARBONYL COMPOUNDS AS THEIR 4-NITROPHENYLHYDRAZONES BY PAPER AND THIN-LAYER CHROMATOGRAPHY. Anal. Chem., v. 40: 984-986, 1968.

4-Nitrophenylhydrazones (I) were used as derivatives for the identification of aromatic carbonyl compounds in automobile exhaust by paper and thin-layer chromatography. For the paper chromatography, papers impregnated with 35% $HCONH_2$-65% EtOH were developed in 70:30:3 cyclohexane (II)-C_6H_6-dipropylene glycol, papers impregnated with 50% Me_2NOCH or with 25% Me_2NOCH-75% EtOH, in 85:15:4 Bu_2O-Me_2NOCH-tetrahydrofuran, and papers impregnated with 20% $HCONH_2$-80% EtOH, in 15:12:7 II-II-$HCONH_2$ [sic]. Silica gel G thin-layer plates were developed in CH_2Cl_2, 95:5 C_6H_6-MeOH, C_6H_6, or 1:1 EtOAc-hexane. R_f values are tabulated for 29 compounds. The exhaust samples were collected in N NaOH, which was then acidified to pH 4. 0 with HCl and extracted with $CHCl_3$. The carbonyl compounds in the $CHCl_3$ extraction were converted to I for chromatography. The separated I were extracted from the chromatographic supports with 95% EtOH and analyzed by uv spectrophotometry. (Chem. Abs.)

253
Bender, D. F.
THIN-LAYER CHROMATOGRAPHIC SEPARATION AND SPECTROPHOTOFLUOROMETRIC IDENTIFICATION AND ESTIMATION OF DIBENZO[a, e]PYRENE. Environ. Sci. & Technol., v. 2: 204-206, Mar. 1968.

Hexacyclic polynuclear hydrocarbons are of interest to air pollution because of their carcinogenic activity and their presence in combustion sources. An investigation was made of both the one-dimensional and two-dimensional thin-layer chromatographic separation of these compounds using mixed substrates. Spectrophotofluorometry was used for identification and estimation purposes. Dibenzo(a, e)pyrene was identified as being present in urban airborne particulate matter obtained from composites of samples from the city of Birmingham and from a combination of various other cities in the State of Alabama. The concentration of dibenzo(a, e)-pyrene in the composite from the combination of various cities in Alabama was estimated to be approximately 100 µg. per gram of benzene soluble. (Author's Abs.)

254
Engel, C. R. and E. Sawicki.
AZULENE PROCEDURE FOR CHROMATOGRAPHIC ANALYSIS OF AROMATIC AND HETEROCYCLIC ALDEHYDES, CARBOHYDRATES, AND OTHER ALDEHYDE PRECURSORS. Microchem. Jour., v. 13: 202-221, 1968.

The detection of conjugated aldehydes and their precursors on paper chromatograms and silica gel thin-layer chromatographic plates with 1% azulene in H_2SO_4 as spray reagent was studied. Azulene can be used to detect aromatic aldehydes, furfural derivatives, sugars, dinitrophenylhydrazones, and azines. Extensive color, sensitivity, and R_f data are presented to compare the azulene method with numerous other detection methods. The azulene method was demonstrated by identifying 5-hydroxymethylfurfural in the ether extract of an effluent from a coffee-roasting plant. The extract was chromatographed on a silica gel plate with 95:5 PhMe-tetrahydrofuran. The azulene method appears to be useful in studying compounds in polluted air. (Chem. Abs.)

255
Engel, C. R. and E. Sawicki.
A SUPERIOR THIN-LAYER CHROMATOGRAPHIC PROCEDURE FOR THE SEPARATION OF AZA ARENES AND ITS APPLICATION TO AIR POLLUTION [STUDIES]. Jour. Chromatog., v. 31: 109-119, Nov. 1967.

A number of aza compounds of interest in air-pollution studies were separated for the first time from the corresponding aromatic hydrocarbons by thin-layer chromatography on silica gel with 7:3 pentane/ether as the developer, or by two-dimensional thin-layer chromatography on 2:1 silica gel/cellulose with 9:1 pentane/ether and 35:65 dimethyl formamide/water as the developers. The separations depended on the amount of steric protection of the aza nitrogen combined with the competitive attraction of the aza nitrogen for silica gel and eluent. In addition, a basic fraction of coal-tar pitch was subjected to column chromatography on silica gel as the adsorbent and pentane mixtures with ether or acetone as the eluents. Both techniques are recommended for analyses of air-borne particulates. (Abs. Refining Lit.)

256
Epstein, S. S., N. Mantel, and T. W. Stanley.
PHOTODYNAMIC ASSAY OF NEUTRAL SUBFRACTION OF ORGANIC EXTRACTS OF PARTICULAR ATMOSPHERIC POLLUTANTS. Environ. Sci. & Technol., v. 2: 132-138, Feb. 1968.

A composite neutral fraction of organic extracts of particulate pollutants was separated chromatographically into 217 subfractions; nine polynuclear aromatic hydrocarbons and five polynuclear ring carbonyl compounds were identified in these subfractions. The distribution of photosensitizing polynuclear compounds in these subfractions was determined using a photodynamic bioassay with Paramecium caudatum; photodynamic potency affords an indirect index of carcinogenicity owing to polynuclear compounds. (Authors' Abs.)

257
Koppe, R. K. and D. F. Adams.
EVALUATION OF GAS CHROMATOGRAPHIC COLUMNS FOR ANALYSIS OF SUBPARTS PER MILLION CONCENTRATION OF GASEOUS SULFUR COMPOUNDS [AIR POLLUTION]. Environ. Sci. & Technol., v. 1: 479-481, 1967.

A bromine coulometric microtitration cell was used to measure the loss of sulfur-containing gases on empty gas chromatographic columns constructed of various materials. Stainless steel was the most satisfactory material tested. Sulfur-compound losses were then determined on stainless steel columns packed with solid support materials and stationary phase liquids in various combinations. Porapak Q was tried as a gas-solid partitioning material. Detection limits for three sulfur compounds on a 10% Triton X-305 Chromosorb G DMCS-treated and a Porapak Q column are reported. Losses on the column require that sulfur compounds in the ambient air within the usual concentration range be concentrated 10- to 50-fold before separation on currently available columns. (Authors' Abs.)

258
Morrison, M. E., and W. H. Corcoran.
OPTIMUM CONDITIONS AND VARIABILITY IN USE OF PULSED VOLTAGE GAS-CHROMATOGRAPHIC DETERMINATION OF PARTS-PER-MILLION QUANTITIES OF NO_2. Anal. Chem., v. 39: 255-258, 1967.

A column of 10 wt % SF-96 on 40/80-mesh Fluoropak 80 at 22° was used to separate NO_2 from N, NO, and O, with Ar as a scavenger and carrier gas. Samples (0.5 ml) containing 88.3 ppm NO_2 were used. For the d-c method with plane parallel electron-capture detector the most sensitive response was with a carrier flow of 10 ml/min, a scavenger flow of 10 ml/min, and a detector potential of 4.5 v. The plane-parallel design required a lower potential and scavenger flow for optimum response in comparison to the opposed-flow Barber Colman detector. With the pulsed mode of operation the response of the plane parallel detector was constant between 10 and 50 v. With a carrier flow of 10 ml/min and a scavenger flow of 30 ml/min, a fraction on-time of 0.027 gave the most sensitive response. The sensitivity was increased ~4-fold at 1-10 ppm NO_2 when the temperature was decreased from 200° to 25°. Nearly all the increase in sensitivity was obtained in the range of 90° to 25°. An increase in the strength of the T source increased the response for a given quantity of NO_2 but the noise level was increased in the same proportion. An acceptable source size was 150-300 mc T with which the number of electrons collected at the anode per emitted β-ray was 5. Optimum sensitivity conditions for a pulse voltage included a carrier gas flow of 10 ml/min, a scavenger flow of 30 ml/min, a pulse output of 50 v with an on-time of 4 μsec and a period of 150 μsec, and a detector temperature of 200°. With a 150 mc T source the noise level was 4 x 10^{-12} amp with a background current of 2.6 x 10^{-9} amp. The average percent deviation was 3.2% for 3-25 ppm NO_2 and 3.4% for 3-75 ppm NO_2. The standard deviation was 0.59 ppm for 3-25 ppm and 1.32 ppm for 3-75 ppm NO_2. (Chem. Abs.)

259
Sawicki, E. and H. Johnson.
THE VARIOUS QUENCHING EFFECTS IN THIN-LAYER CHROMATOGRAPHY. APPLICATION TO AIR POLLUTION.
Jour. Chromatog., v. 23: 142-148, 1966.

Eight fluorescence quenching techniques of value in the direct analysis of spots on thin-layer chromatograms are discussed. Use of an insoluble quencher in the adsorbent is of benefit in the selective analysis of fluorescent compounds. It is predicted with the help of polymeric materials containing nitro, phenolic, amino, anilino, thiocarbonyl, ketonic carbonyl, hydrazine, azo, and nitroso groups quick highly selective methods of direct quenchofluorometric analysis of spots on a plate will be possible for compounds containing various types of functional groups. This type of functional group analysis should approach the simplicity of colorimetry. Examples are given of the application of some of these techniques to the analysis of urban air pollutants. The following compounds have been readily and quickly characterized by the fluorescence quenching techniques: acridine, benz(a)acridine, benz(c)acridine, 7H-benz(d, e)anthracen-7-one, benzo(f)quinoline, benzo(h)quinoline, phenalen-1-one and xanthen-9-one. All of these compounds were found in the examined polluted urban atmospheres. (Authors' Abs.)

260
Sawicki, E., H. Johnson, and M. Morgan.
COMPARISON OF FLUORIMETRIC METHODS OF ASSAY FOR 7H-BENZ(DE)ANTHRACEN-7-ONE IN AIRBORNE PARTICULATES AND AIR POLLUTION SOURCE EFFLUENTS.
Microchimica Acta (Wien), v. 2: 293-305, Mar. 1967.

Various modifications of a thin-layer chromatography fluorimetric method for the determination of 7 H-benz(de)anthracen-7-one (BO) and phenalen-1-one (PO) in complex mixtures have been compared. The best modifications consisted of one-dimensional thin-layer chromatography followed by elution, evaporation, solution in trifluoroacetic acid, followed by either spectrophotofluorimetric or fluorimetric assay. In some cases a quenching agent was necessary to quench the fluorescence of the interferences. Urban atmospheres and air pollution source effluents can be analyzed by these micromethods. These methods with slight modification could be applied to the determination of the aza heterocyclic and the other ring-carbonyl compounds found in urban atmospheres and air pollution source effluents. (Air Poll. Abs.)

261
Urone, P., J. F. Parcher, and E. N. Baylor.
NONLINEAR DISTRIBUTION COEFFICIENTS IN GAS CHROMATOGRAPHY. Separation Sci., v. 1: 595-612, 1966.

Nonlinear partition coefficients of polar solutes on coated and uncoated diatomaceous-earth supports were treated mathematically. The adsorption of Me_2CO was studied on acid-washed firebrick columns, both uncoated and coated with squalane and tri-o-tolyl phosphate. The approach and procedure used were that of Urone and Parcher. Adsorption and distribution isotherms were calculated from adsorption-desorption chromatograms whose diffuse elution curves approached the base line asymptotically. With the uncoated support, Me_2CO adsorption obeyed the Temkin isotherm equation; a plot of the amount adsorbed vs the log of solute concentration in the carrier gas is linear. The adsorption of Me_2CO on coated columns followed a Freundlich isotherm equation. Retention volumes were calculated from the equation $V_{Ng} = dQ/dC$, where V_{Ng} is the retention vol/g of coated support, Q is the amount of sample adsorbed, and C is the mole fraction concentration of solute in the carrier gas. Retention volumes can be correlated with sample size if the contribution of the bulk liquid phase is known. Stronger adsorption bonds are formed at lower temperatures. (Chem. Abs.)

(d) Spectrophotometry

262
Altshuller, A. P.
ANALYSIS OF ORGANIC GASEOUS POLLUTANTS. In: Air Pollution. v. II: Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 115-145.

Mass spectrometry, infrared techniques and flame ionization analyzers have been adapted for monitoring instruments, but colorimetric and gas chromatographic techniques (useful in the laboratory) have not. Details of organic gaseous pollutant analyses are presented. Distinctions are made between the analysis for hydrocarbons, aliphatic oxygenated compounds, sulfur containing compounds, halogenated compounds and aliphatic nitrogen compounds.

263
Chakrabarti, C. L.
DETERMINATION OF LEAD IN AQUEOUS AND ORGANIC MEDIA BY ATOMIC-ABSORPTION SPECTROSCOPY. Appl. Spectros., v. 21: 160-164, 1967.

The sensitivities of Pb in aqueous and organic media by atmospheric absorption spectroscopy by using Pb lines 2170, 2833, and 4058 A., and an O-H or O-C_2H_2 flame were studied. When Pb in aqueous solution was complexed as K_2PbI_6 and the complex extracted into iso-PrCOMe, a 3-fold increase in sensitivity relative to the aqueous solution of Pb (as $Pb(NO_3)_2$ was obtained by using a 178-mm.-long adapter on the top of a Beckman integral aspirator-burner (O-H), a sensitivity (in ppm./1%) absorption) of 0.007 and a standard deviation of 0.014 ppm. were obtained with a sample containing 0.1 ppm. Pb. Results obtained with O-H and O-C_2H_2 flames are discussed, and the precision and detection limits indicated. A procedure to detect Pb in ppb.-ppm level by extracting Pb as K_2PbI_6 in iso-PrCOMe has been prescribed. (Chem. Abs.)

264
Cohen, I. R.
SPECTROPHOTOMETRIC DETERMINATION OF HYDROGEN PEROXIDE WITH 8-QUINOLINOL. Anal. Chem., v. 39: 131-132, Jan. 1967.

A spectrophotometric procedure to determine microgram quantities of hydrogen peroxide makes use of the colored complex obtained upon extraction of titanium - hydrogen peroxide mixtures with a 0.1% solution of 8-quinolinol in chloroform. Application of this method to analyze vapor concentrations is also discussed. (Public Health Eng. Abs.)

265
Coleman, I., and M. J. D. Low.
THE DETECTION OF PESTICIDES BY MEANS OF INFRARED EMISSION SPECTROSCOPY. In: Developments in Applied Spectroscopy, v. 5: New York, Plenum Press, 1966, p. 193-201. (Proc. 16th Annual Mid-America Spectroscopy Symposium, Chicago, Ill., June 14-17, 1965).

Infrared emission spectra of DDT, Sevin, Malathion, and Dieldrin (insecticides) have been measured with a multiple-scan interference spectrometer. The exploratory experiments indicate that quantities of pesticides in the microgram range can be examined. (Authors' Abs.)

266
Green, A. E. S., D. T. Williams, R. S. Sholtes and others.
THE MIDDLE ULTRAVIOLET AND AIR POLLUTION. In:
The Middle Ultraviolet: Its Science and Technology. Ed. by
A. E. S. Green. New York, John Wiley & Sons, 1966,
p. 158-164.

Currently in the air pollution field a great effort is underway to find and develop more specific methods of measuring contaminants. It appears that ultraviolet spectroscopy would be an important tool in measuring these trace species. The important pollutants such as nitrogen dioxide, sulfur dioxide, and ozone all have strong absorption coefficients in the ultraviolet, as do many of the other lesser pollutants and the products of the photochemical reactions which play such a large role in smog formation. Both chemical and spectroscopic methods have their advantages and disadvantages. Perhaps the greatest importance in utilizing ultraviolet spectroscopy is that a program which complements the chemical program could be obtained. The two programs working together should indeed contribute significantly to the body of knowledge which is necessary to solve the air pollution problem. (APTIC Abs.)

267
Dauerman, L., G. E. Salser, and Y. A. Tajima.
CHARACTERIZATION OF VOLATILIZED SPECIES FROM SOLID
PROPELLANTS. AIAA Jour., v. 5: 1501-1503, 1967.

The preignition phase of solid-propellant combustion is studied by using a fast-scanning mass spectrometer directly attached to a subatmospheric-pressure strand burner. The volatilized species are continuously sampled into the mass spectrometer through a conical sample probe of 0.002 in.-diam.-orifice, which is 19 mm. from the ion source. The strand is 5 mm. from the orifice. Results obtained for a double-base propellant heated by radiant energy from an arc image furnace at a pressure of 15 mm.of He (containing 1% Ar) are described. It is suggested that the changes in the mass spectra observed show that 1 stage of combustion may be represented by NO_3 + triacetin → CO + CHO + H_2O + NO. However, neither the NO_3 nor the triacetin is completely identified. (Chem. Abs.)

268
Grune, W. N. and H. S. Atlas.
EVALUATION OF FALLOUT CONTAMINATION OF WATER SUPPLIES. Merrimack College, North Andover, Mass. Final Technical Rept., Oct. 1, 1963-May 15, 1965. May 15, 1965, 217p. AD 466691.

A theoretical evaluation was conducted to detect the potential degree of water contamination from fallout and to assess the biological hazards associated with the ingestion of water following hypothetical nuclear attack. The appraisal was carried out by applying the assigned fallout model to various levels of nuclear war and by quantity correlation of all phases of the flow of radioactive fallout in public water supplies. The water supply systems of 3 cities were selected for the evaluation of water contamination to study the potential hazards and radiobiological effects from the ingestion of fallout contaminated water. These results indicate that water contamination for some cities may be at a substantial level of fallout concentration, especially when watershed runoff is included. A detailed analysis of various criteria for biological uptake was completed. Results from 4 mathematical model of biological uptake were in close agreement. The possible internal hazard due to ingestion of contaminated water for the populations residing in the 3 selected cities was estimated, and the values of the absorbed doze for total body for different starting times and ingestion periods were summarized. (Chem. Abs.)

269
Hauser, T. R. and M. A. Kolar.
SPECTROPHOTOMETRIC DETERMINATION OF HYDROGEN PEROXIDE IN AQUEOUS MEDIA WITH 1,2-DI-(4-PYRIDYL)-ETHYLENE. Anal. Chem., v. 40: 231-232, Jan. 1968.

A new spectrophotometric method for the determination of hydrogen peroxide in aqueous solutions is described. Hydrogen peroxide reacts with 1,2-di-(4-pyridyl)ethylene to form pyridine-4-aldehyde among other products. Once the pyridine-4-aldehyde is formed, it is reacted with 3-methyl-2-benzothiazolinone hydrazone to form a yellow dye which is measured spectrophotometrically. The molar absorbtivity for hydrogen peroxide in the procedure is 36,500. The final color analyzed was found to be stable for at least 30 hours and hence is easily stable enough for analysis. The method offers good sensitivity and reproducibility for the determination of hydrogen peroxide in aqueous media. (APTIC Abs.)

270
Lovelock, J. E., D. C. Fenimore, and A. Zlatkis.
ELECTRON ATTACHMENT SPECTROSCOPY. Jour. Gas. Chromatog., v. 5: 392-394, 1967.

Analytic electron attachment spectroscopy was studied by using an electron capture detector. The variation of the extent of electron absorption in the gas phase with different electron energies was measured for PhCl, $PhCH_2Cl$, PhCHO, and $PhNO_2$. A range of electron energies from thermal (0.03 ev.) to ~1.0 ev. was observed. The ratio of electron absorption of PhCl and PhCHO was 20:1 at thermal energies and 1:50 at ~0.8 ev. Although at the present stage it is imprecise, the technique is simple and may be capable of revealing characterizations useful in analytical gas chromatography. (Chem. Abs.)

271
Low, M. J. D.
MEASUREMENT OF THE INFRARED SPECTRAL REFLECTION OF SOME COMMON MINERALS AND ROCKS USING MULTIPLE-SCAN INTERFEROMETRY. Appl. Opt., v. 6: 1503-1506, 1967.

The ir reflection spectra (2500-250 cm.$^{-1}$) of some minerals and rocks were recorded with a multiple-scan interference spectrometer. Samples were small, irregular, and unpolished. Spectra were obtained with some samples approximately 1 mm. in diameter. Emission of samples was obviated by using the interferometer as a chopper. (Chem. Abs.)

272
Low, M. J. D.
SUBTLER INFRARED SPECTROSCOPY. Internat. Sci. & Technol., v. 62: 52-58, Feb. 1967.

Smogged-in urbanites will welcome a new "snooper" on the air-pollution scene. It's the multiple-scan interferometer, and it's so sensitive it can detect pollutants emerging from chimneys and car exhausts. The scientist in the lab is finding it useful too. (Air Poll. Abs.)

273
Low, M. J. D. and F. K. Clancy
REMOTE SENSING AND CHARACTERIZATION OF STACK GASES BY INFRARED SPECTROSCOPY—APPROACH USING MULTIPLE-SCAN INTERFEROMETRY. Environ. Sci. & Technol., v. 1: 73-74, Jan. 1967.

A sensing instrument used for measuring the IR emission spectra of stack gases was a Block Model 200 IR interference spectrometer situated in a ground location remote from the stack. The interference spectrometer covers the range 2500 to 250 cm^{-1} in a scan of 1-sec duration, with a resolution of approximately 18 cm^{-1}. The IR emission spectra of a stack effluent is shown. (Eng. Index)

274
Low, M. J. D., R. Epstein, and A. C. Bond.
INFRARED SPECTRA OF METHYLDIBORANES. THE EXAMINATION OF UNSTABLE SUBSTANCES USING MULTIPLE-SCAN INTERFERENCE SPECTROSCOPY. Chem. Commun., v. 67: 226-228, 1967.

Methylated diborane equilibrium mixtures were carefully fractionated and their ir spectra were obtained as a function of time by using a rapid scan interferometric spectrometer. The spectra changed rapidly with time and differed significantly from those reported previously. Alkyldiborane disproportionation reactions are rapid enough such that spectra taken with conventional scanning instruments will yield misleading results. (Chem. Abs.)

275
Low, M. J. D. and H. Inoue.
INFRARED EMISSION SPECTROSCOPY OF SOLIDS USING DISPERSION INSTRUMENTS. Develop. Appl. Spectros., v. 5: 203-215, 1965.

Ir emission spectral studies of carboxylic acids on metal surfaces and of various solids indicate that this method can be applied for the examination of the surfaces of opaque bulk solids. Emission experiments were made with steel, Al, Ag, Au, Cd, Zn, and Sn surfaces with stearic, oleic, linoleic, and linolenic acids with good results. Silicone stopcock grease on Al and paint on steel were also studied. (Chem. Abs.)

276
Mueller, P. K.
DESIGN OF AZO-DYE REAGENTS FOR NITROGEN DIOXIDE ANALYSIS. (Presented at: 59th Air Poll. Control Assoc., Annual meeting, San Francisco, Calif., June 20-24, 1966).

Azo-dye reagents are used for the spectrophotometric analysis of nitrogen dioxide in air. The performance of these reagents depends upon the molecular structure of the components, pH, ionic strength, and relative concentration of the components.

These factors can be tailored to meet the practical requirements of different applications. In current practice the most frequently used azo-dye reagent in continuously analyzers is a formulation containing 5.0% acetic acid, 0.005% N(1-naphthyl)-ethylenediamine dihydrochloride and 0.5% sulfanilic acid in water (modified Saltzman reagent). When using large volumes (liters) of reagent the acetic acid becomes both a hygienic and corrosion nuisance. The design factors for formulating azo-dye reagents were applied to the development of a nuisance free reagent with analogous performance. Several promising reagents were evaluated including tests for stability to light and air oxidation. The performance of new reagents was tested in a continuous air analyzer using nitrogen dioxide streams together with sulfur dioxide, ozone and nitric oxide as possible interferences. A new reagent system is recommended for use in currently operating dioxide analyzers. (Air Poll. Abs.)

277
Pitts, J. N., Jr., G. W. Cowell, and D. P. Burley.
FILM ACTINOMETER FOR MEASUREMENT OF SOLAR ULTRAVIOLET RADIATION INTENSITIES IN URBAN ATMOSPHERES. Environ. Sci. & Technol., v. 2: 435-437, 1968.

A versatile chemical actinometer, suitable for field as well as laboratory studies, was developed for the measurement of radiation intensities in the near-uv region. The actinometer is a thin film of poly(methyl methacrylate) in which the actinic material, o-nitrobenzaldehyde, is dispersed. On absorption of radiation in the 2800-4100-A. region o-nitrobenzaldehyde photoisomerizes to o-nitrobenzoic acid with a quantum efficiency of 0.50. The extent of this reaction upon irradiation can be related to the intensity of the radiation source. This actinometer is suitable for measuring solar radiation intensities within the region 3000-4100 A., the photochemical reactive wavelength region for the production of photochemical smog. (Chem. Abs.)

278
Sachdev, S. L., J. W. Robinson, and P. W. West.
DETERMINATION OF MANGANESE, IRON, COBALT AND NICKEL IN AIR AND WATER BY ATOMIC ABSORPTION SPECTROSCOPY. Analytica Chimica Acta (Amsterdam), v. 38: 499-506, Aug. 1967.

Flames of 4 different kinds and of various compositions were studied for their suitability for atomic absorption spectroscopy for the determination of manganese, iron, cobalt, and nickel. The effects of various other factors such as lamp current, slitwidth, and position of the burner were also investigated. Interference effects of a large number of ions and compounds were studied. Very few ions were found to interfere, and means of eliminating the interferences noted are described. As a result of the investigation, sensitive and selective procedures for the determination of manganese, iron, cobalt, and nickel are reported. Sensitivities are Mn, 0.01 mg/liter; Fe, 0.05 mg/liter; Co, 0.03 mg/liter, and Ni, 0.02 mg/liter for 1% absorption. (APCA Abs.)

279
Sawicki, E. and R. A. Carnes.
SPECTROFLUORIMETRIC DETERMINATION OF ALDEHYDES WITH DIMEDONE AND OTHER REAGENTS. Mikrochimica Acta (Wien), v. 8: 148-159, 1968.

Four spectrofluorimetric methods (A-D) are described and compared with literature methods for determination of aliphatic aldehydes. (A) To 2 ml. of aqueous sample solution, add 2 ml of aqueous reagent containing 25 g. NH_4OAc, 0.3 g. dimedone, and 0.4 ml. of distilled HOAc/100 ml. Heat the mixture for 10 minutes on a boiling water bath. Cool and measure the fluorescence at 395/460 mμ (excitation emission) within 5 minutes (B) Follow procedure A through cooling. Add 3 ml. of 40% aqueous Et_4NOH. Measure the fluorescence at 460/522 mμ within 5 minutes. (C) To 2 ml. of aqueous sample solution, add 2 ml. of an aqueous solution containing 0.2 g. of 1,3-cyclohexanedione and 0.3 ml. of HOAc/100 ml. Heat the mixture for 10 minutes at 70°. Cool, and measure the fluorescence at 395/460 mμ within 10 minutes. (D) Follow procedure C through cooling. Add 3 ml. of 40% aqueous Et_4NOH. Measure the fluorescence at 460/505 mμ. The methods were most sensitive to HCHO and least sensitive to the unsaturated aldehydes. Beer's law was obeyed for 0.04-0.9 μg./ml. in the final solution for HCHO by method A. For 12 determinations of HCHO standard deviations were ± 3.9, 5.6, 10.0, and 10.0% for methods A-D. Methods A and B are more sensitive for HCHO than C and D. These methods were compared with literature methods. For HCHO, J-acid is most sensitive, 2,4-pentanedione is most selective. Dimedone is most sensitive to aldehydes other than HCHO. (Chem. Abs.)

280
Sawicki, E., R. A. Carnes, and R. Schumacher.
SPECTROPHOTOFLUORIMETRIC DETERMINATION OF 3-CARBON FRAGMENTS AND THEIR PRECURSORS WITH ANTHRONE. APPLICATION TO AIR POLLUTION. Mikrochimica Acta (Wien), v. 7: 929-935, 1967.

Modification of methods for the spectrophotofluorimetric determination of C_3 fragments and their precursors with anthrone are presented. Acrolein, analogous fragments, and their precursors were determined by adding 3 ml. of 0.1% anthrone in H_2SO_4 to 2 ml. of an aqueous solution containing the sample and after 10 minutes adding 3 ml. of HOAc. The spectra were recorded at 470-85 and 560-70 mμ. The standard deviation for 10 determinations was ± 4.5 and the calibration curve was linear for 3-40 μg. of 1,1,3,3-tetramethoxypropane. For pyruvaldehyde, analogous fragments, and precursors which could not be detected by this method, add 0.5 ml. of 0.3% anthrone in HOAc to 2 ml. of the aqueous solution containing the sample, cool on an ice bath, add 3 ml. H_2SO_4, and heat on a boiling water bath for 7 minutes. The fluorescence spectra of the compounds were recorded at 460-4 and 505-13 mμ. The standard deviation for ribose was ± 5.3 for 9 determinations and the calibration curve was linear for 10-200 μg. ribose. Water-soluble fractions of air-borne particulates were analyzed by the 2nd procedure. (Chem. Abs., Modified)

281
Sawicki, E. and H. Johnson.
PHOTOMETRIC DETECTION OF PRIMARY AMINES. Chemist-Analyst, v. 55: 101-103, 1966.

To 1 ml. 2,5-dimethoxytetrahydrofuran (0.5% in HOAc) is added 2 ml. test solution, the mixture is heated on a steam bath 5 min., 2 ml. p-(dimethylamino)benzaldehyde (I) solution. (2% in 85:15 mixture HOAc-HCl) is added; after 2 min. the mixture is cooled, and the absorbance measured at $\lambda_{max.}$ against reagent blank. Instead of I, p-(dimethylamino)cinnamaldehyde can be used. (Chem. Abs.)

282
Scaringelli, F. P., B. E. Saltzman, and S. A. Frey
SPECTROPHOTOMETRIC DETERMINATION OF ATMOSPHERIC SULFUR DIOXIDE. Anal. Chem., v. 39: 1709-1719, Dec. 1967. (Presented in part at: 150th Meeting, Amer. Chem. Soc., Atlantic City, N. J., Sept. 13-15, 1965 and at the 151st Meeting, Amer. Chem. Soc., Pittsburgh, Pa., Mar. 23-24, 1966.)

Two improved pararosaniline methods developed for the spectrophotometric determination of SO_2 in ambient air yield greater sensitivity, greater reproducibility, and adherence to Beer's Law, throughout a greater working range than the West and Gaeke method. These improvements resulted from optimization of the important parameters. The pararosaniline dye was specially purified and standardized to reduce variability problems. H_3PO_4 was used in the final color development to control pH, to liberate SO_2 from its mercury complex, and to complex heavy metals. The pararosaniline methyl sulfonic acid produced in the reaction exhibited a hypsochromic spectral shift and behaved as a two-color pH indicator, the color changing from magenta (peak wavelength 575 millimicrons) to red (peak wavelength 548 millimicrons). Interferences from oxides of nitrogen, ozone, and heavy metals were minimized. Results were reproducible to within 4.9% (at 95% confidence level) if the analyses were done carefully with close attention to temperature, pH, purity of the dye and water, and standardization of the sulfite solution. The methods have been tested on air samples from major cities in the United States and have been used routinely for almost a year. (Authors' Abs.)

283
Thompson, C. R., L. F. Zielenski, and J. O. Ivie
A SIMPLIFIED FLUOROMETRIC FLUORIDE ANALYZER.
Atmos. Environ., v. 1: 253-259, May 1967.

A fluorometric fluoride analyzer previously described (Ivie et al., 1965) has been redesigned and simplified to provide a more usable instrument. A single photomultiplier tube is used to receive alternate light pulses rather than the two tubes used formerly. Illumination of the sensitized tape is accomplished by two ultraviolet lamps. The electronic circuitry for tape illumination and carrying of signals to the recorder has been simplified. A light "piping" system improves light transmission and the bulk and weight of the overall equipment has been reduced to about one-half. (Authors' Abs.)

(e) Radioactive and Laser

284
Barrett, E. W. and Oded Ben-Dov
APPLICATION OF THE LIDAR TO AIR POLLUTION MEASUREMENTS. Jour. Appl. Meteorol., v. 6: 500-515, June 1967.

An urgent need exists for a technique of rapid and economical measurement of vertical profiles of atmospheric particulate concentration. It is shown in this paper that the lidar, or optical radar, is capable of meeting this need. The first part of the paper presents the physical basis of the technique wherein equations based on the Mie scattering theory and the radar equation are derived which permit quantitative calculation of the particulate concentration, turbidity index, and horizontal visibility from the lidar data as functions of height. The remainder of the paper is devoted to a brief description of an operational lidar system, some examples of results obtained with it, and an evaluation of its performance during six months of use. A subsequent paper will present some detailed case studies of pollution episodes in the Chicago Metropolitan area. (Authors' Abs.)

285

Dimitriades, B.

METHODOLOGY IN AIR POLLUTION STUDIES USING IRRADIATION CHAMBERS. Jour. Air Poll. Control Assoc., v. 17: 460-466, July 1967.

Experimentation in large irradiation chambers has been useful in providing insight into the chemistry of the photochemical smog formation problem. Initial efforts to reproduce the atmospheric phenomena artificially at controllable scale were successful in that gross atmospheric smog symptoms were observed in irradiation chambers. However, as the experimentation and evidence produced were becoming more elaborate, the question arose as to how much one could rely on chemical data in understanding and interpreting atmospheric phenomena. The question becomes highly pertinent in view of the difference in concentration levels between atmosphere and chamber work. This issue was discussed during recent American Chemical Society meetings, and the conclusions from presentations and discussions were as follows: (1) There is qualitative agreement between chamber data and atmospheric data wherever comparison is feasible. (2) There is need for more precise chamber work at concentration levels more nearly equal to those in the atmosphere. Experimentation in chambers under typical atmospheric conditions presents some special problems associated with the chamber design and chemical analysis. Chamber methodology has been the focus of considerable research effort, and it appears to be an important factor affecting further progress in air pollution research. This paper describes methods and techniques used at the Bartlesville Petroleum Research Center. (Author's Abs.)

286

Hashimoto, Y. and J. W. Winchester

PREPARATION OF CARRIER-FREE RADIOACTIVE TRACERS OF SELENIUM AND TELLURIUM. Radiochimica Acta (Frankfurt/Main), v. 7: 217, 1967.

^{75}Se and $^{121}Te^{m}$, ^{121}Te, and ^{123}Te are produced by the 15-Mev. d bombardment of As and Sb_2O_3, respectively, in a cyclotron. To prepare carrier-free Se, dissolve the As in a few ml. of aqua regia, dilute to 20 ml. with 6N HCl, and add 20 mg. Te(VI) carrier. Precipitate Te (Se) by boiling in the presence of N_2H_4. Centrifuge, decant, wash, and dissolve the precipitate with HNO_3. Repeat the precipitation procedure twice. Add 20 ml. each of HCl and HBr and 40 ml. H_2O to the HNO_3 solution and distil Se in an air stream containing Br_2 until 70 ml. of distillate is collected. Repeat the distillation 3 times. Evaporate the final distillate to a convenient volume after adding 20 ml. of HNO_3. To prepare carrier-free Te, dissolve the Sb_2O_3 in 6N HCl, filter, and add 100 mg. of Se(IV) carrier. Coprecipitate Te by the reduction of Se in hot solution with N_2H_4. Dissolve the precipitation with HNO_3 and repeat the precipitation 3 times in the presence of Sb, Sn, and Fe carriers. Remove any Se radioactivity by 2 distillations. Dissolve the residue in 20 ml. of HCl, add 1 mg. of $NaBrO_3$, and pass through a 10 cm. Dowex 1-X8 resin column. Wash the column with 50 ml. of 3N HCl and elute Te with 20 ml. of 0.3N HCl. Concentrate the effluent to 5 ml., make 6N in HCl, and extract with 10 ml. of 1% thiocarbanilide in $CHCl_3$. Shake the organic phase with 2.5 ml. of HNO_3, add 15 ml. of H_2O, and separate the aqueous phase. Wash this with 20 ml. of 3: 1 PhH-$CHCl_3$ to obtain the Te in the aqueous phase. (Chem. Abs.)

287

Lloyd, R. D., J. A. Christensen, B. W. Church and others.
POLYSPEC: A COMPUTER PROGRAM TO RESOLVE COMPLEX GAMMA-RAY SPECTRA FROM SAMPLES OF DIFFERENT DENSITIES. Health Physics, v. 13: 851-855, 1967.

A computer program has developed which can be used to resolve gamma-ray spectra from samples containing a number of radionuclides by the method of simultaneous equations. No restriction as to the number or identity of gamma-ray emitters is imposed by the program. It is designed to utilize data from samples of any density from 0.1 to 1.0 g/cm^3 and will calculate radionuclide concentrations corrected for the effect of density on counting rate. (Authors' Abs.)

288

Sawicki, E. and J. D. Pfaff
QUENCHOPHOSPHORIMETRIC ANALYSIS FOR CONJUGATED COMPOUNDS. Microchimica Acta (Wien), no. 1/2: 322-333, 1966.

A new method of analysis that incorporates many of the reagents found useful in quenchofluorometry is introduced. Examples of this technique are given, e.g., the determination of p-nitroaniline in the presence of carbazole, p-hydroxyacetophenone, triphenylamine and triphenylene, all of which are intensely phosphorescent. (APCA Abs.)

(f) Sampling

289

Calvert, S.

AIRCRAFT ARE NEEDED TO GATHER SMOG DATA. Mach. Design, v. 40: 35, Jan. 1968.

The Director of California's Air Pollution Research Center predicts that specially equipped airplanes will be sampling polluted air in various parts of the state. Such flying laboratories would be superior to ground stations and mobile laboratories in range, scope and efficiency. (Air Poll. Abs.)

290

Cleeves, G. A., T. J. Lemmons, and C. A. Clemons.

A LOW-LEVEL AIR SAMPLING AND METEOROLOGICAL SOUNDING SYSTEM. Jour. Air Poll. Control Assoc., v. 16: 207-211, 1966.

A captive-balloon borne radio transmitting device measuring temperature and humidity at desired levels in the lower 1,000 feet of the atmosphere over a city is described. A companion device which captures a sample of air at a desired altitude and a method of later determining trace gas concentrations in the sample is presented. Temperature, humidity, and methane concentrations in air samples taken above Cincinnati were determined and are presented as examples of the system's capabilities. (Authors' Abs.)

291

Corn, M.

ADHESION OF ATMOSPHERIC DUSTFALL PARTICLES TO A GLASS SLIDE. Nature, v. 211: 60-61, July 1966.

Centrifugal acceleration and high velocity air stream are used in evaluating particle adhesion. (Public Health Eng. Abs.)

292
Corn, M.
NONVIABLE PARTICLES IN AIR. In: Air Pollution. v. I. Air Pollution and Its Effects. Ed. by A. C. Stern, New York, Academic Press, 1968, p. 47-74.

Atmospheric aerosol particles form a heterogeneous population with respect to size, morphology, electrical properties, composition, and concentration. The aerosol is in a dynamic state of change as a result of the physical and chemical properties of both the particles and the atmosphere. Extension of the knowledge of the mechanics of aerosols to describe their behavior in the atmosphere, with its complex fluid dynamic patterns is fragmentary. Particles in the atmosphere also participate in chemical reactions with the surrounding gases and with each other. The "chemical profile" of an air basin is highly individualistic, dependent on the input of aerosols from natural, industrial domestic and mobile sources of pollution in the region. Methods of assessment of nonviable particles in the air must advance if understanding of atmospheric phenomena associated with airborne particles is to progress. The chemical composition of nonviable particles in the area must be studied with respect to particle size. The latter parameter dictates the life of the aerosol particles in the air, while together these parameters determine the aerosol potential to evoke responses in human or inanimate receptors. (Author's Abs.)

293
Corn, M., R. Quinlan, and J. Katz
THE OPTICAL EVALUATION OF ATMOSPHERIC DUSTFALL. Atmos. Environ., v. 1: 227-238, 1967.

Present methods for assessing atmospheric dustfall measure the weight of settled particles, but the nuisance produced by dustfall is a visual one which is associated with particle projected area. A rapid, simple experimental technique is proposed to evaluate the projected area of dustfall collected on microscope slides during sampling periods as short as 4 hr. The method is based on exposing the slide to evaporated aluminum in a vacuum chamber, followed by removal of adhering particles to produce an opaque slide with transparent apertures formed during evaporation. The area of the apertures is determined on an optical bench by measuring light transmission through the treated slide. The experimental procedures and apparatus are discussed in detail. (Authors' Abs.)

294
Corn, M., F. Stein, and N. Esmen
THE SHAPE OF ATMOSPHERIC PARTICLES. Univ. of Pittsburgh, Pa., Dept. of Occupational Health, Progress Report Apr. 1, 1966-Aug. 30, 1967, Nov. 1, 1967 [67]p.

Additional laboratory studies with the Goetz Spectrometer have indicated that it is feasible to chemically analyze the entire width of the particle deposit, rather than count particles on the centerline deposit. The methods used to verify the proposed experimental approach and analyses of data were verified by calibrations with Uranine dye aerosol. Recommended procedures can be used for determination of the size distribution of aerosol in the particle size range of 0.5 - 3.0 M aerodynamic equivalent diameter. Suspended particulate matter was sampled on a roof by means of a horizontal elutriator. Particles were classified according to the ratio of projected area diameter (d_p) to aerodynamic equivalent diameter (d_e) and also according to particle shape. The value (d_p/d_e) varied from 0.5 to 3.0. Estimates of the size frequency weight distribution of particles based on d_p differed by as much as 500% from the distribution derived from d_e. The average range of occurrence of (d_p/d_e) for different particle shapes was determined. High volume samplers were used to collect suspended particulate matter for determination of bulk density, true density (solid phase only), and total specific surface area by BET gas adsorption techniques. Average bulk density and standard deviation of seven samples collected over one to two week sampling periods was 0.594 ± 0.051 grams/cm^3. Average true density was 2.147 ± 0.205 grams/cm^3. Average Total Specific surface of eight samples was 2.81 ± 0.86 m^2/gram for samples degassed at room temperature. For the same samples degassed at 200°C, average total specific surface area was 5.61 ± 1.50 m^2/gram. Efforts devoted to elemental, as well as anion and cation analyses of samples collected with the Goetz Spectrometer are briefly described. (APTIC Abs.)

295
Crider, W. L.
SPECTROTHERMAL EMISSION AEROSOL PARTICLE ANALYZER (SEAPA). Rev. Scient. Instr., v. 39: 212-215, 1968.

An instrument that selectively counts, according to size, aerosol particles containing certain specific metals is described. The technique employed is based on the principle of spectrothermal emission of individual particles passing through the combustion zone of a H-air flame. After the flash of light from each emitting particle passes through a monochromator, it is converted to a voltage pulse which is electronically counted according to height. The instrument sensitivity was determined for aerosols of NaCl, $CaCl_2$, CaO, Fe_2O_3, KOH, LiOH, MnO_2, and MgO. The minimum size particle detectable varied from 0.10-μ diam. for NaCl to 1.22-μ diam. for MgO. (Chem. Abs.)

296
Crider, W. L., N. P. Barkley, and A. A. Strong
DRY POWDER AEROSOL DISPERSING DEVICE WITH LONG TIME OUTPUT STABILITY. Rev. Scient. Instr., v. 39: 152-155, Feb. 1968.

Operating parameters and performance characteristics are described for a dry powder Fe_2O_3 aerosol dispersers used for periods up to 23 hours with minimal operator attention. Aerosol mass concentration fluctuations in a 4-cubic-meter dynamic flow chamber were determined over 23 hour periods for the aerosol generator with and without electronic feedback circuits. From the data presented and from observations made during 2 weeks of continuous operation, this "rust duster" was found to be capable of continuously dispersing Fe_2O_3 powder into 2 cubic meters of air per minute to produce aerosols having median concentrations from about 0.7 to 3.0 milligrams per cubic meter. Over most of this concentration range, with or without the feedback control circuit, the mass concentration of Fe_2O_3 aerosol was kept within the plus or minus percent variability originally set as acceptable for chronic animal exposure conditions. (Authors' Abs.)

297
Crider, W. L. and A. A. Strong
FLAME IONIZATION-PULSE AEROSOL PARTICLE ANALYZER (FIPAPA). Rev. Scient. Instr., v. 38: 1772-1775, 1967.

An instrument is described that counts automatically according to size aerosol particles of certain specific chemical composition. The technique employed depends on converting to current pulses the ions produced from airborne particles passing through the combustion zone of a flame. Because the amplitude of the current pulse resulting from an ionized particle passing through a flame is dependent on both the mass and the ionization potential of the particle, the FIPAPA can aid in submicron aerosol particle identification when used in combination with instruments employing other sensing-zone types. By use of electronic pulse-height circuits, these current pulses are subsequently counted in 6 ranges of magnitude. The minimum size particle detectable was found to be 0.15 μ diameter for KOH and 0.25 μ diameter for NaCl. (Chem. Abs.)

298
Dorsey, J. A. and D. A. Kemnitz
A SOURCE SAMPLING TECHNIQUE FOR PARTICULATE AND GASEOUS FLUORIDES. Jour. Air Poll. Control Assoc., v. 18: 12-14, Jan. 1968.

Sampling of effluents that contain fluorides is often hampered by the reactivity of hydrogen fluoride. Although techniques have been developed for sampling ambient air, they are not applicable to stack effluents which contain higher concentrations of fluoride, water, and particulates. A sampling system for the separation and collection of gaseous and particulate fluorides was devised and tested. In this system a heated glass probe serves as a reactor for converting hydrogen fluoride to silicon tetrafluoride before the particulate is filtered. Laboratory tests have demonstrated quantitative recoveries of hydrogen fluoride after the test mixtures pass through the probe and through filter papers impregnated with sodium bicarbonate. The equipment has performed satisfactorily in field sampling. (Authors' Abs.)

299
Falgout, D. A. and C. I. Harding
DETERMINATION OF H_2S EXPOSURE BY DYNAMIC SAMPLING WITH METALLIC SILVER FILTERS. Jour. Air Poll. Control Assoc., v. 18: 15-20, 1968. (Presented at: 60th Annual Meeting Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967)

A new method for the determination of H_2S exposure has been developed. As air is drawn through a silver membrane filter, H_2S present reacts to form AgS. This results in a decrease in the reflectance of the silver surface. Darkening due to impingement of particles is eliminated by protecting the Ag membrane with a cellulose membrane prefilter. Air is metered with a limiting orifice. The reflectance of the Ag membrane is measured before and after exposure and the decrease in reflectance is proportional to the H_2S dose or exposure. (Authors' Abs.)

300
Farr, A. F.
SPECIMEN SAMPLING AND DILUTING APPARATUS. U. S. Patent 3,273,402 (Cl. 73-425.6), Sept. 20, 1966, 4p.

A precise, durable, and self-cleaning sampling and diluting device that is comparatively inexpensive is described. The apparatus can be envisioned as being composed of 2 parts that are joined by a tube. One part of the apparatus consists of a sampling device, in which a tube is extended down into the sample, and by way of a suction-piston, the sample is drawn up into this tube. After the tube has been filled, the sample vessel is removed and replaced by a mixing container. The 2nd part of the apparatus delivers a known amount of diluent into the above mentioned tube, thus washing the sample and the diluent into the mixing chamber. The diluent is delivered by a piston device. Suitable valves are used to prevent back flow and contamination. This apparatus is of particular use for measurement and dilution of liquid specimens for subsequent quantitative chemical analysis. (Chem. Abs.)

301
Flesch, J. P., C. H. Norris, and A. E. Nugent, Jr.
CALIBRATING PARTICULATE AIR SAMPLERS WITH MONODISPERSE AEROSOLS: APPLICATION TO THE ANDERSEN CASCADE IMPACTOR. Amer. Indus. Hyg. Assoc. Jour., v. 28: 507-516, Nov.-Dec. 1967.

Monodisperse aerosols of methylene blue dye generated via a spinning disk and polystyrene latex aerosols generated via atomization have been applied in calibrating a multistage cascade impactor, the Andersen sampler, Model 0203. The reported method obviates many difficulties encountered with the size-count method of calibration commonly employed. Collection efficiency characteristics of the Andersen sampler are computed directly from mass retained at the deposition sites, since concurrent size distribution information on each aerosol generated indicates that values for number and mass median diameter are nearly equal. Experimental methods of generation, sampling, mass determination, and aerosol evaluation are presented with representative data. Collection efficiency curves obtained for the various stages of the Andersen sampler are given with computed values of effective stage cutoff diameters for aerodynamically equivalent unit-density spheres. Results are compared with those of previous experimenters. (Authors' Abs.)

302
Foster, K. E., D. L. Brooman, and P. A. Humphrey.
MOBILE AIR SAMPLING STATIONS INTEGRATE AIR MONITORING DATA. Air Eng., v. 9: 12, 14-15, May 1967.

Based on the anticipated field air-monitoring needs of a nationwide Federal abatement program, the National Center for Air Pollution Control designed and had constructed an integrated mobile air-sampling station (MASS). The interior of a commercially available travel trailer was altered to accept a complement of automatic air-monitoring, meteorological, and data-handling equipment. The station will continuously monitor and record ambient air quality and meteorological parameters. Information derived from these observations will facilitate the identification of contaminants, measurement of concentration under varying meteorological conditions, and determination of source or sources. The pollutant-monitoring equipment in the MASS trailer is essentially the same as that used in the Continuous Air Monitoring Program (CAMP). However the advantage inherent in these automatic analyzers is expanded by coupling them with instruments that continuously record on-site meteorological data. With the flexibility afforded by the mobility of the MASS trailer, the station can be relocated within a given study area with a minimum of difficulty, or used successively in several widespread study areas. Application of the MASS trailer will generally be confined to large metropolitan areas or population centers where the full complement of equipment can be used to the greatest effect. As planned, the MASS trailer will be utilized in air quality studies of 6- to 12-month duration. Although the MASS trailer can be conveniently moved with nominal preparation (2-3 days), the cost and effort involved in securing a suitable site and utilities with each move greatly increases operating costs. For studies longer than 1 year, the advantages of the trailer are reduced and economics may favor establishment of a fixed station. (APTIC Abs.)

303
Fracchia, M. F., F. J. Schuette, and P. K. Mueller.
A METHOD FOR SAMPLING AND ANALYSING CARBONYL COMPOUNDS IN CAR EXHAUST. (Presented at: 152nd meeting, Amer. Chem. Soc., New York, Sept. 11-16, 1966).

One hundred liters of exhaust are sampled at a rate of one liter per minute through a probe inserted six inches into the tail pipe. The exhaust then passes through a water trap and two bubblers in series. Carbonyl compounds are selectively and quantitatively trapped as hydrazones in bubblers containing an aqueous 2, 4 dinitrophenylhydrazine reagent. The carbonyl compounds in the water trap are precipitated as hydrazones by addition of the hydrazine reagent. The hydrazones in the trap and in the bubblers are collected by filtration and extraction, dissolved in carbon disulfide and analyzed by gas chromatography using a flame ionization detector. The role of potential interferences has been evaluated. Sampling efficiencies and analytical errors have been established for several compounds. The occurrence and concentration of C_1 to C_6 carbonyl compounds under several operating modes is described. (Air Poll. Abs.)

304
Frank, E., W. H. Fischer, and J. P. Lodge, Jr.
A SPECIAL PROCEDURE FOR MAKING STRUCTURE OF MEMBRANE FILTERS VISIBLE. [Eine spezielle Sichtbarmachung von Membranfilterstrukturen]. Staub Reinhaltung der Luft in English, v. 26: 244-245, June 1966.

Membrane filters stained with lead sulfide are partially dissolved in an organic solvent and subsequently dried again in very thin films that can be observed directly in the electron microscope. (APCA Abs.)

305
Friedlander, S. K.
PARTICLE DIFFUSION IN LOW-SPEED FLOWS. Jour. Colloid and Interface Sci., v. 23: 157-164, 1967.

The theory of diffusional exchange between flowing fluids and surfaces was extended to the case of diffusing particles of finite diameter. A modification of the thin concentration boundary-layer theory is used to derive similitude laws for particle diffusion to cylinders and spheres and to solve for the transfer rate at the forward stagnation point. (Chem. Abs.)

306
Friedlander, S. K. and C. S. Wang
THE SELF-PRESERVING PARTICLE SIZE DISTRIBUTION FOR COAGULATION BY BROWNIAN MOTION. Jour. Colloid and Interface Sci., v. 22: 126-132, Aug. 1966.

The solutions to the kinetic equation of coagulation are reviewed particularly from the standpoint of their asymptotic behavior. The result of this study indicates that the shape of the self-preserving spectrum is greatly influenced by the form of the collision frequency factor. (APCA Abs.)

307
Friedlander, S. K.
THEORY OF SELF-PRESERVING SIZE DISTRIBUTIONS IN A COAGULATING DISPERSION. U.S. Atomic Energy Comm., Symposium Ser., v. 5: 253-259, 1965.

A reduced form of the particle-size-distribution function, designated "self-preserving" satisfies the Smoluchowski equation of coagulation by Brownian motion. Both theory and experiment indicate that the self-preserving form is approached by coagulating systems having a wide variety of initial distributions. This effect offers an explanation for the regularities observed in the size distribution of the atmospheric aerosol. (Chem. Abs.)

308
Harstad, J. B., H. M. Decker, M. Buchanan, and others.
AIR FILTRATION OF SUBMICRON VIRUS AEROSOLS. Amer. Jour. Public Health, v. 57: 2186-2193, 1967.

A new method is described for evaluating air filters with submicron aerosols. The method is unique in that the aerosols were viable, highly concentrated, and composed entirely of submicron particles (0.1μ NMD [number median diameter]). Tests were conducted to compare air filters in removing submicron T_1 phage aerosols and bacterial aerosols of Bacillus subtilis variant niger spores (1μ NMD). (Biol. Abs.)

309
Hauser, T. R. and D. W. Bradley
EFFECT OF INTERFERING SUBSTANCES AND PROLONGED SAMPLING ON THE 1, 2-DI-(4-PYRIDYL) ETHYLENE METHOD FOR ANALYSIS OF OZONE IN AIR. (Presented at: 153rd Meeting, Amer. Chem. Soc., Miami Beach, Fla., Apr. 10-14, 1967).

A more detailed study of the effects of nine possible interfering substances on the 1, 2-di-(4-pyridyl) ethylene method for the specific analysis of ozone in the air is described. In addition, the effect of long term (24 hr.) sampling as compared to short-term sampling (30 min.) is also reported. Results show that none of the interfering substances tested cause an interference in the method using a 30-min. sampling time, and only three substances tested could possibly interfere during 24-hr. sampling when it is assumed that the interfering substance tested is present in the ambient air in normally found concentration ranges. The results also demonstrate that there is no loss of ozone from the adsorbing solution during 24-hr. sampling due to a possible aeration effect and therefore the method can be used for 24-hour sampling. (Air Poll. Abs.)

310
Hendrickson, E. R.
AIR SAMPLING AND QUANTITY MEASUREMENT. In: Air Pollution, v. II. Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 3-52.

General sampling problems and equipment are discussed. Details on the sampling of aerosol or gaseous contaminants are discussed. Special attention is given to the sampling of sulfur dioxide, gaseous fluorides, hydrogen sulfide and ozone. The types of recording instrumentation and principles of measurement are presented.

311
Horstman, S. W., Jr. and J. Wagman
SIZE ANALYSIS OF ACID AEROSOLS BY A METAL FILM TECHNIQUE. Amer. Indus. Hyg. Assoc. Jour., v. 28: 523-530, Nov.-Dec., 1967.

A technique for size determination of acid aerosol droplets by use of vacuum-evaporated metal films is described. The films, ranging from 0.2 to 0.6 micron thick, develop reaction spots on exposure to acid aerosols. Films were used in several size-classifying collection devices to detect and size laboratory-generated acid aerosols. Evaluation of the reaction spots was by light or electron microscopy. Preliminary results of atmospheric sampling with iron films in the Goetz aerosol spectrometer are presented. Extension of the method for detection and sizing of acid droplets with diameters less than 0.1 micron by electron microscopy is described. Requirements for increasing resolution to permit the detection and size analysis of acid aerosols with diameters of 0.01 micron are discussed. (Authors' Abs.)

312
Ivie, J. O. and E. R. Hendrickson
PERFORMANCE CHARACTERISTICS OF STACK AND AMBIENT FLUORIDE RECORDER. (Presented at: 153rd Meeting, Amer. Chem. Soc., Miami Beach, Fla., Apr. 10-14, 1967.)

Description and response characteristics of two automatic hydrogen fluoride samples are compared with accumulated samples collected with Greenburg-Smith impingers. A special liquid pump is used to improve coulometric method of Howard and Weber for stack sampling in the 2 to 1000 p.p.m. range. An ambient hydrogen fluoride sampler with fluorescent tape (as in the SRI instrument) is used in the 0 to 2 p.p.b. range. The new instrument balances two fluorescent outputs against a standard potential, then the difference between the two potentials is recorded. (Air Poll. Abs.)

313
Jutze, G. A. and K. E. Foster
RECOMMENDED STANDARD METHOD FOR ATMOSPHERIC SAMPLING OF FINE PARTICULATE MATTER BY FILTER MEDIA—HIGH-VOLUME SAMPLER. Jour. Air Poll. Control Assoc., v. 17: 17-25, Jan. 1967.

The recommended techniques for ambient air monitoring of fine particulate matter include instrument description and operation (a sampler consisting of a specially housed vacuum sweeper motor to which is attached a filter holder or adapter), sample collection and preparation for analysis and methods for the determination of metals, nonmetals and gross β-radioactivity in particulate matter collected on glass fiber filters, and a method for extraction of organic materials from particulate matter collected on glass-fiber filters. (Eng. Index)

314

Keenan, R. G.
STANDARDIZATION OF CHEMICAL METHODS IN AIR SAMPLING. Amer. Indus. Hyg. Assoc. Jour., v. 28: 144-147, Mar.-Apr. 1967.

A brief discussion of the separate and combined efforts over the past 25 years of 6 professional organizations in the United States leading toward the standardization of methods of analysis for atmospheric samples is presented. The modus operandi, the accomplishments, and concept of the future program of the Committee on Recommended Analytical Methods of the American Conference of Governmental Industrial Hygienists are discussed. (Author's Abs., Modified)

315

Keng, E. Y. H. and C. Orr, Jr.
THERMAL PRECIPITATION AND PARTICLE CONDUCTIVITY. Jour. Colloid and Interface Sci., v. 22: 107-116, Aug. 1966.

Aerosol particles in a thermal gradient experience a force tending to drive them in the direction of the lower temperature. The force has been described both as strongly dependent and as almost independent of particle thermal conductivity. An analysis of new precipitation data involving both high and low conductivity particles reveals thermal forces to be of almost identical magnitudes regardless of conductivity. (Authors' Abs.)

316

Kramer, D. N. and P. W. Mitchell
EVALUATION OF FILTERS FOR HIGH-VOLUME SAMPLING OF ATMOSPHERIC PARTICULATES. Amer. Indus. Hyg. Assoc. Jour., v. 28: 224-228, May-June 1967.

A practical evaluation was carried out on commercially available glass fiber filter materials for use in the high-volume sampling of atmospheric suspended particulates. Studies were carried out on the collection efficiency of the various filter materials under equilibration and nonequilibration conditions. Values were obtained of the ratio of decreased airflow through the filter at constant pressure drop as a function of particulate loading. It was concluded that improvements need to be made in the physical uniformity of the sampling matrices. A variation in suspended particulate values was observed employing standard techniques, but generally the filters were self-consistent. It was further concluded that the high-volume sampling method is only a semiquantitative measurement and that simpler and more accurate methods are required. (APTIC Abs.)

317
Kramer, C. L. and S. M. Pady
A NEW 24-HOUR SPORE SAMPLER. Phytopathology, v. 56: 517-520, May 1966.

A new continuous slit-type spore sampler has been developed, known as the Kramer-Collins spore sampler. Fungus spores 3 μ or larger are collected on glass slides, in bands, one band per hour. The sampler may be run continuously or intermittenly through the hour, and can be operated on household current or car battery. At an air flow of 0.8 ft^3/min, efficiency is 100% at wind speeds of approximately 2 mph, declining with increasing wind velocity. The sampler has been used to sample cereal rusts, rusted plants on the prairie, and fleshy fungi in the woods. Certain accessories were found to be useful: a rain cover, elbows with 1-inch rubber tubing, and sampling tubes. Sampling tubes have been used to sample spores from individual leaves for periods up to 10 days. By this means diurnal periodicity in wheat and bean rust have been studied in the greenhouse. (Authors' Abs.)

318
Langer, G.
RESEARCH ON THE ACOUSTIC PARTICLE SENSOR AND ITS APPLICATION TO AIR DIFFUSION STUDIES. Jour. Air Poll. Control Assoc., v. 17: 597-598, Sept. 1967.

A typical acoustic sensor consists of a 2.5-cm diam glass tube gradually tapering into a 6 cm long, 1.5 mm diam capillary, which then abruptly increases to a 2.5 cm diam exit tube. Particles drawn through the capillary at approximately 50 m/sec suddenly slow down in the exit section, where they produce an audible click lasting 1-2 msec. Initial work has shown that particles down to 20 μ can be detected; however, little size discrimination exists. The object of research in progress at NCAR is to extend the sensitivity of the instrument and try to use it for particle sizing. At reduced pressure the loss in sensitivity is quite pronounced: at 8 psi the sensor responds only to particles over 100 μ. In an effort to size particles, further research is in progress to understand how the sensor functions. A system, in which a microphone functions effectively both in the exit and entrance, made it possible to show that the sound originates at the exit and is due to a flow disturbance created by the particle somewhere in the capillary. (Air Poll. Abs.)

319
Lee, R. E., Jr., R. K. Patterson, and J. Wagman
PARTICLE-SIZE DISTRIBUTION OF METAL COMPONENTS IN URBAN AIR. Environ. Sci. and Technol., v. 2: 288-290, Apr. 1968.

Concentration and particle-size distribution of six suspended metals (iron, lead, cadmium, chromium, magnesium, and copper) were measured in downtown Cincinnati and in Fairfax, a Cincinnati suburb. Particulate was collected and size-fractionated in cascade impactors; the metals were extracted with acids and analyzed by atomic absorption spectrophotometry. Samples obtained from the two locations exhibited different particle-size distributions; at both locations, however, only lead was predominantly submicron. Concentrations of the metals were typically three to five times higher in Cincinnati than in Fairfax; magnesium concentrations were about seventeen times higher. (Authors' Abs.)

320
Liu, B. Y. H., K. T. Whitby, and H. H. S. Yu
ELECTROSTATIC AEROSOL SAMPLER FOR LIGHT AND ELECTRON MICROSCOPY. Rev. Scient. Instr., v. 38: 100-102, Jan. 1967.

A two stage electrostatic aerosol sampler capable of accurate sampling of micron and submicron size aerosols onto any flat collecting surface of an area up to 5 x 10 cm^2 is described. Size classification of the deposited aerosol is prevented by the use of a novel pulsed precipitating electric field. Sampling efficiency and the uniformity of the deposited aerosol has been determined using monodispersed fluorescent aerosols over the size range from 0.028 to 3.2 μ. The sampler has been found to be very satisfactory for obtaining aerosol samples for electron or light microscopy. (Authors' Abs.)

321
Lodge, J. P., Jr., J. B. Pate, B. E. Ammons, and others
THE USE OF HYPODERMIC NEEDLES AS CRITICAL ORIFICES IN AIR SAMPLING. Jour. Air Poll. Control Assoc., v. 16: 197-200, Apr. 1966.

Hypodermic needles are useful as convenient low-cost critical orifices to control the flow rate in air sampling. Variations in flow rate were less than 5% for 41 needle gauge-length combinations. To provide maximum accuracy, a simple calibration procedure is described. Needles may be reused more than 6 times, if protected. Types of protectors are described. Resistances of protector, collector, and prefilter combinations affect criticality at 9 1/min. Simple sampling devices using needles as orifices are described. (Authors' Abs.)

322
McCrone, W. C.
MORPHOLOGICAL ANALYSIS OF PARTICULATE POLLUTANTS. In: Air Pollution. v. II. Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 281-301.

The microscope permits detailed studies of smokes, dust, fogs, and other aerosols. A good analyst can determine the different particles in a given dust sample or determine the presence, and percentage, of particles from any specific source. The collection and mounting of particles is discussed briefly. A table giving a reasonably complete list of morphological characteristics useful in their identification is included. The identification of particulates is discussed and color plates of various pollutants are included.

323
McCrone, W. C., R. G. Draft, and J. G. Delly
THE PARTICLE ATLAS. Ann Arbor, Michigan, Ann Arbor Science Publishers Inc., 1967, 406p.

This photomicrographic reference book for the microscopic identification of particulate substances is divided into three main parts. The first part is concerned with the basic princples and techniques including: (1) optics and the microscope, (2) collection of atmospheric particulates, (3) preparation of samples for microscopical examination, and (4) analytical techniques. The second part is an atlas containing photographs of a wide range of particulate types and a brief description of each. The third part is composed of tables providing additional analytical data to aid in the classification of the particulates.

324
Ogden, E. C. and G. S. Raynor
A NEW SAMPLER FOR AIRBORNE POLLEN: THE ROTO-SLIDE. Jour. Allergy, v. 40: 1-11, July 1967. (Presented in part at the 1963 Meeting, Amer. Acad. Allergy, Montreal, Canada, 1963.)

This study was conducted to determine the type of pollen sampler which would be the most acceptable replacement for the standard Durham sampler since it has been shown that the amount of pollen captured by the Durham sampler was determined by several other factors than the concentration of the pollen in the air. The intermittent rotoslide sampler is designed to take pollen samples which are representative of the average concentration over a 24-hr period by operating automatically and periodically for short periods. The pollen is collected on the edges of two microscope slides in metal holders which are rotated by a small electric motor. The leading edge of the slide protrudes from the holder and is so oriented that it is always at right angles to the direction of motion. The sampling edge of the slide is coated with a thin layer of silicone grease. The counting is done at 100 x, the count is independent of wind speed and direction, and the collection efficiency is approximately 64% for pollen. The device samples at the rate of 60 litters per min. In the development of the proposed sampler, considerations of accuracy, use in the field under varying weather conditions, simplicity of operation, ease of counting, conversion of counts to a volumetric basis, and cost led to the development of the instrument described. (APTIC Abs.)

325
O'Keeffe, A. E., G. C. Ortman, and B. E. Saltzman

MONITORING OF REACTIVE ATMOSPHERIC HYDROCARBONS. (Presented at: 152nd Meeting, Amer. Chem. Soc., New York, Sept. 11-16, 1966.)

Methods of atmospheric monitoring are needed to discriminate between hydrocarbons on the basis of their reactivities in the formation of photochemical smog. Among possible methods, oxidation was deemed most promising. Solid oxidants were considered to offer advantages of effectiveness and convenience. Data are presented for a number of oxidant formulations in terms of their abilities to react with typical hydrocarbons in air at the realistic levels of 0.1 to 1.0 ppm, and to attenuate their responses to flame ionization. A dual monitoring system was used to determine the difference between total hydrocarbons and the non-reactive fraction passing an oxidative absorber. Accuracy of this difference signal was increased by minimizing instrumental drift. (Air Poll. Abs.)

326
Parker, W. R. and N. A. Huey
MULTIPURPOSE SEQUENTIAL SAMPLERS. Jour. Air Poll. Control Assoc., v. 17: 388-391, June 1967.

Presented is the design, construction, and field utilization of a sequential sampling system for monitoring gaseous pollutants capable of detection by "wet chemical" techniques. Also described are specially designed midget impingers and bubblers for field and laboratory use. (Authors' Abs.)

327
Paulus, H. J. and C. M. Peterson
URBAN AEROSOL: COUNT-SIZE RELATED TO METEOROLOGIC DATA. Jour. Air Poll. Control Assoc., v. 17: 575, Sept. 1967.

Instruments capable of measuring the number of particles present in specific size increments over the range from 0.002 to approximately 8 μ in diameter are being used to automatically and continuously record the variation in atmospheric aerosol concentration and distribution at an urban location, on a local Minneapolis-St. Paul television tower. The research will provide insight into the efficacy of using meteorological factors to forecast atmospheric diffusion rates and furnish information on the naturally occurring changes in particle count and size distribution due to the influence of weather conditions. This may lead to the evaluation of meteorological forecasts as a basis for decisions of voluntary control of contaminant discharges or of the invocation of regulatory procedures and precautionary measures. (Air Poll. Abs.)

328
Potzl, K. and R. Reiter.
[THE RESPIRATORY TRACK MODEL AS A RETENTION SIMULATOR IN PRACTICAL USE.] Das Atemtraktmodell als Retentionssimulator im praktischen Einsatz. Zentralblatt für biologische Aerosol Forschung (Stuttgart), v. 13: 372-381, May 1967.

A four-stage filter simulating the human respiratory tract was used in eight industrial locations, for example a cement kiln and a fluorite mine. The distribution of Fe_2O_3, SiO_2, Al_2O_3, and CaO particles over the filter stages was measured, as well as their radioactivity and electrical charge. The usefulness of the model, to determine the retention of aerosols in the respiratory tract according to both particle size and material properties was demonstrated. (APTIC Abs.)

329
Pritchard, W. L., C. E. Schumann and C. W. Gruber.
SELECTION OF A SUITABLE ADHESIVE-COATED CYLINDER FOR THE COLLECTION OF AIRBORNE PARTICULATES. Amer. Indus. Hyg. Assoc. Jour., v. 28: 517-522, Nov.-Dec. 1967.

Vertically mounted cylinders circled by adhesive-coated paper have been used by the Cincinnati Division of Air Pollution Control for collecting atmospheric dusts since 1955. Realizing the potential application of this method, a U. S. Public Health Service (Division of Air Pollution) Research Grant was obtained to support the development of standard criteria for particulate sampling by adhesive-coated materials. During the first year of the project, considerable effort was devoted to the selection of the sample holder which would provide optimum effectiveness in the collection of particles over 20 microns in diameter. The results of this work clearly indicate that a cylinder wrapped with a selected commercially available adhesive paper provides an effective atmospheric sampler for nuisance dusts. (Authors' Abs.)

330
Pritchard, W. L., C. E. Schumann, and C. W. Gruber.
SELECTION OF ADHESIVE-COATED MATERIALS FOR PARTICULATE SAMPLING. Jour. Air Poll. Control Assoc., v. 17: 305-307, May 1967.

The use of adhesive surfaces for the collection and evaluation of airborne particulates, including radioactive dusts and aeroallergens, is steadily increasing. Although many types of adhesives and adhesive-coated materials are commercially available, very few are suitable for continuous monitoring applications. Late in 1964, the Cincinnati Division of Air Pollution Control received a U. S. Public Health Service, Division of Air Pollution, Research Grant for the refinement and standardization of a method of particulate sampling utilizing adhesive surfaces as collection media. One of the first phases of this project was to select the adhesive-coated material best suited for the method. The research which led to this selection, from a group of 37 different materials, is reported. (Authors' Abs.)

331
Reist, P. C., W. A. Burgess, and M. W. First.
CURRENT AEROSOL RESEARCH AT THE HARVARD SCHOOL OF PUBLIC HEALTH. Jour. Air Poll. Control Assoc., v. 17: 608, Sept. 1967.

The APA light-scattering particle detector is a small (5.5 lb) portable unit which automatically counts and sizes individual particles using principles discussed by Gucker and O'Konski and others and is similar in operation to several other light-scattering devices. This unit has been developed by NASA for use on the Apollo missions and has been described in detail by Leavitt and Laverv. (Air Poll. Abs.)

332
Roach, S. A., H. E. Ayer, and R. L. Harris.
TESTING COMPLIANCE WITH THRESHOLD LIMIT VALUES FOR RESPIRABLE DUSTS. Amer. Indus. Hyg. Assoc. Jour., v. 28: 543-550, Nov.-Dec. 1967.

It is important that a hygienic standard is not open to widely different interpretations. This paper discusses the errors and standardization of the impinger dust count and recommends where, when, and how many impinger samples to take when testing compliance with the ACGIH threshold limit values for respirable dusts evaluated by count. The term "breathing zone" should be defined; for example, we may specify that the impinger should be located upstream and within 2 feet of the worker's nose and mouth. The samples should be spread throughout a shift or complete cycle of operations. The optimum sampling schedule is 32 samples each 15 minutes in duration. Factors are developed to enable the results to be compared with the TLV when, as is usual, the sampling schedule falls short of this optimum requirement. Present methods used for determining silica in the dust appear to be adequate for the purpose, at least for dusts with high silica content. (Authors' Abs.)

333
Robinson, J. W., R. E. Harrington, and P. W. Spaite.
A NEW METHOD FOR ANALYSIS OF MULTICOMPARTMENTED FABRIC FILTRATION. Atmos. Environ., v. 1: 499-508, July 1967.

Pilot scale research which led to development of a mathematical model describing the operation of three compartment parallel flow baghouses, is described. The model is shown to accurately relate loading of the gas being filtered, dust permeability, and time elapsed between successive compartment cleaning operations to the resulting drag (inherent resistance to flow) of the filtering medium and pressure drop across the medium. The potential usefulness of the principles involved is discussed. (Authors' Abs.)

334
Sawicki, E., T. W. Stanley, W. C. Elbert and others.
COMPARISON OF METHODS FOR THE DETERMINATION OF BENZO (a) PYRENE IN PARTICULATES FROM URBAN AND OTHER ATMOSPHERES. Atmos. Environ., v. 1: 131-145, Mar. 1967.

A group of methods for the determination of BaP in air and in other complicated mixtures are compared. Many of the methods are introduced in this paper and all have been applied to the determination of BaP in airborne particulates. Some of the factors which have been compared are precision, accuracy, man-hours of work and total analysis time. Specific recommendations are given for methods by means of which a high order of selectivity, a maximum amount of information, a considerably reduced analysis time, or a low cost of analytical operation are possible. The use of the relatively low cost fluorimetric procedure is achieved with the loss of simultaneous characterization. (Authors' Abs.)

335
Scaringelli, F. P., S. A. Frey, and B. E. Saltzman.
EVALUATION OF TEFLON PERMEATION TUBES FOR USE WITH SULFUR DIOXIDE. Amer. Indus. Hyg. Assoc. Jour., v. 28: 260-266, May-June, 1967.

Use of permeation tubes has been proposed as a simple technique for preparing accurate primary standard low concentrations of gaseous air pollutants. Liquefied gas is sealed in FEP Teflon tubes with glass or metal balls. The gas permeates through the walls of the tube at a rate fixed by the geometry of the system and by the properties of the compound. At constant temperature the permeation rate is constant. This study of tubes containing sulfur dioxide includes comparison of the gravimetric method of calibration with more specific methods of analyses for sulfur dioxide. Comparison of the average rates determined colorimetrically and coulometrically with the average rates computed from weighing the tubes over a period of 600 hours gave ratios of 95.5% for the thin-walled (0.012-inch) and 97.5% for the thick-walled (0.030-inch) tubes. These results indicate that Teflon permeation tubes are extremely useful for preparing accurate concentrations of atmospheric pollutants, for calibrating instruments, and for developing or comparing analytical methods. Temperature is a critical variable that must be controlled within ± 0.1°C. (Authors' Abs.)

336
Shulman, H. L., G. R. Youngquist, and J. R. Covert.
DEVELOPMENT OF A CONTINUOUS COUNTERCURRENT FLUID-SOLIDS CONTACTOR (ION EXCHANGE). Indus. Eng. Chem. Process and Design Develop., v. 5: 257-260, July 1966.

The development and testing of new equipment for continuous countercurrent ion exchange are discussed. Mass transfer coefficients characterizing the performance of the equipment have been obtained for a wide range of operating variables. Mass transfer in the liquid phase is indicated as the rate-controlling factor for Cu^{+2}-Mg^{+2} exchange with Amberlite IR-120 and mass transfer coefficients have been correlated as a function of the relative velocity between the liquid and resin. (APTIC Abs.)

337
Taheri, M. and R. K. Barton.
A TECHNIQUE FOR DETERMINING PENETRATION AS A FUNCTION OF PARTICLE DIAMETER. Amer. Indus. Hyg. Assoc. Jour., v. 29: 252-256, May-June 1968.

A technique has been developed for obtaining the relationship between particle penetration (or collection efficiency) and diameter from experimental data. A general mathematical treatment provides the means of utilizing size distributions into and out of the experimental system for computing exact point values of efficiency. Previously published methods employ a difference or averaging technique which gives collection efficiency over a range of particle diameters. A new experimental technique enables one to use the Goetz aerosol spectrometer with convenience and rapidly to provide the needed data. (Authors' Abs.)

338
Turk, A. and S. Mehlman.
CORRELATIONS BETWEEN INSTRUMENTAL AND SENSORY CHARACTERIZATIONS OF ATMOSPHERIC ODORS. Amer. Soc. Testing and Mater., Special Tech. Publ., No. 440: 27-35, 1967.

The sampling and characterization of atmospheric odor sources are discussed. Sensory evaluation of atmospheric odors and correlation with instrumental characterization, e.g., by ir spectroscopy, are included. (Chem. Abs.)

339
West, P. W. and S. K. Thabet
MICRODETERMINATION OF Zn BY REAGENT CRAYONS AND THE RING-OVEN TECHNIQUE. Analytica Chimica Acta (Amsterdam), v. 37: 246-252, 1967.

A sensitive and highly selective method for the rapid microdetermination of Zn by the ring-oven technique is presented. Very few cations when present in 100-fold excess interfere while anions do not interfere. The optimum range is 0.1—1.0 μg. Zn, which suggests its special applicability in air pollution investigations. (Chem. Abs.)

340
Went, F. W.
THE NATURE OF AITKEN CONDENSATION NUCLEI. Tellus (Stockholm), v. 18: 549-556, 1966.

The number of Aitken condensation nuclei in the air is strongly influenced by human activities which increase the natural number manifold through release of combustion products from fires and combustion engines. The natural condensation nuclei near ground level increase during day and decrease during night; there is a general decrease with increasing altitude in the atmosphere. These natural Aitken nuclei are produced in light from volatile products released by the vegetation (mainly terpenes) and therefore are organic macromolecules. They disappear again mainly by agglomeration, on or near the inversion layers, and are then removed by precipitation. (Air Poll. Abs.)

341
Whitby, K. T.
AEROSOL RESEARCH AT THE UNIVERSITY OF MINNESOTA. Jour. Air Poll. Control Assoc., v. 17: 576-578, Sept. 1967.

A new condensation generator is described and the polystyrene aerosols produced by it are examined. An aerosol counting system capable of rapid sizing of aerosols over the range of sizes from approximate 0.002 to 10μ has been assembled and studied. The electrical properties of aerosols and the concentration and size distribution of particles from 0.001 to 3μ in radius dispersed in the urban atmosphere were measured with a continuous-sampling sizing system composed of a nuclei counter, an electrical particle counter, and an optical counter. (Air Poll. Abs.)

342
Whitby, K. T.
SHEATH AIR AEROSOL INLET TUBE FOR THE ROYCO PC-200. In: Evaluation of Optical Particle Counters. Univ. of Minnesota, Dept. of Mechanical Engineering, Minneapolis. Final Report No. AP 00283-2, June 1967, p. 1-3.

A common problem experienced with the Royco PC-200 particle counter is the filling of the optical system with aerosol as aerosol is sampled. The problem could only be completely eliminated by using a clean air sheath around the aerosol. A double wall inlet tube of simple design which may be installed in the standard instrument without any modification or disassembly of the optical system itself is described. The clean air sheath is provided by by-passing some of the entering aerosol through a capillary and then through an absolute filter. The flow resistances of the by-pass are such that the flow can be adjusted to be exactly equal to the aerosol flow down the center tube. With the standard inlet tube, it sometimes took as long as two hours for the optical system to rid itself of particles after sampling atmospheric aerosol for twenty minutes or more. With the new inlet tube the count will go to zero in less than one minute regardless of the concentration of aerosol previously sampled. There appears to be no buildup of aerosol in the optical chamber with the new inlet tube. No change in the basic performance of the instrument has appeared when using the new inlet tube. (APTIC Abs.)

343
Whitby, K. T. and W. E. Clark.
ELECTRIC AEROSOL PARTICLE COUNTING AND SIZE DISTRIBUTION MEASURING SYSTEM FOR THE 0.015 TO 1μ SIZE RANGE. Tellus (Stockholm), v. 18: 373-585, 1966.

The electrical particle counter and size analyzer system described have the following characteristics: (1) Sizing range from 0.015 to 1.2 μ. (2) Classification range from 0.015 to 0.6 μ at 28 l/m aerosol sampling rate. (3) A unique unipolar diffusion charger that is stable, controllable and capable of near optimum charging performance. (4) A versatile mobility analyzer capable of discrete classification of particles with mobilities from 0.01 to 0.0002 (cm/sec)/(volt/cm) at aerosol flow rates up to 57 l/m. This analyzer is unique in using a filter located at the aft end of the current collector. This separation of the collecting electrode and the current collector permits the use of collector voltages up to 30 KV while maintaining background currents below 10^{-14} amp. Although the instrument described here is only semi-automatic, a completely automatic version of the EPC is entirely practical. An automatic EPC used together with an automatic CN and optical counter would permit continuous automatic size distribution measurement over the size range from 0.01 to 10 μ. (Air Poll. Abs., Modified)

344
Whitby, K. T. and B. Y. H. Liu.
GENERATION OF COUNTABLE PULSES BY HIGH CONCENTRATION OF SUBCOUNTABLE SIZED PARTICLES IN THE SENSING VOLUME OF OPTICAL PARTICLE COUNTERS. In: Evaluation of Optical Particle Counters. Univ. of Minnesota, Particle Technol. Lab., Minneapolis. Final Report. June 1967, 25p. (Particle Lab. Publ. No. 110).

It is shown by analysis and has been confirmed by experiment that large numbers of sub-countable particles in the sensing zone of single particle optical counters generate spurious counts in the counting range of the instrument. A statistical theory has been developed which is capable of predicting the size distribution and number of the spurious pulses from the concentration and particle size of the sub-countable aerosol. The theory has been extended to atmospheric aerosols obeying the distribution law $dN/dD_p = 0.41$ phi D^{-4} and it is shown that the many sub-countable particles present in atmospheric aerosols can account for the false mode often observed when single particle optical counters are used to size concentrated urban aerosols. It is also shown that the numerous sub-countable residue particles present in the atomized polystyrene latex aerosols can generate spurious pulses in the lower channels, thereby affecting the accuracy of this calibration method. (APTIC Abs.)

345
Whitby, K. T. and B. Y. U. Liu.
POLYSTYRENE AEROSOLS--ELECTRICAL CHARGE AND RESIDUE SIZE DISTRIBUTION. Atmos. Environ., v. 2: 103-116, Mar. 1968.

The complete size distribution of polystyrene aerosols produced from a dilute hydrosol of the polystyrene latex particles by the atomization and evaporation process has been measured over the size range 0.002-5 μ in 18 size intervals by means of an aerosol counting and size-distribution measuring system consisting of three instruments in parallel operation: a General Electric condensation nuclei counter, an electric particle counter and a Royco optical particle counter. The concentration of the residue particles resulting from the evaporation of the empty liquid droplets containing no PSL particles has been found to be approximately five orders of magnitude higher than the monodisperse PSL particles. The use of an impactor with a sharp 2-μ droplet cut-off has been shown to be effective in improving the monodispersity of the generated polystyrene aerosol. The improvement apparently has resulted from the reduced number of multiplets formed. The electrostatic charge on the PSL particle has been measured and the median charge has been found to be on the order from 10 to 100 elementary electron units. However, some particles have been found to carry over 600 units of charge. Charges of these magnitudes are approaching or even exceeding the maximum charge that can be placed on these particles in an electrostatic precipitator and undoubtedly can have a very substantial effect on the behavior of the aerosol. A radioactive Kr-85 gas of 0.5 mc activity has been found to be an effective means of neutralizing the aerosol charge. (Authors' Abs.)

346
Whitby, K. T. and R. A. Vomela.
RESPONSE OF SINGLE PARTICLE OPTICAL COUNTERS TO NONIDEAL PARTICLES. Environ. & Sci. Technol., v. 1: 801-814, Oct. 1967. (Also published in: Evaluation of Optical Particle Counters. Univ. of Minnesota, Particle Technol. Lab., Minneapolis. Final Report, June 1967, 46p. (Publ. No. 110)).

The response of the Royco PC 200, Southern Research Institute (RSI), and Bausch and Lomb (B and L) single particle counters to nonideal but mono-dispersed aerosols has been measured. Aerosols used were polystyrene latex, dioxtylphthalate, India ink, and polystyrene. The indicated size of the absorbing India ink was 1/2 of the true size for all of the counters. The Royco and SRI counters, which accept light through only a small solid angle, indicated a considerable spread in size distribution for the India ink and polystyrene particles which had some surface roughness. The resolution on rough-surfaced aerosols was better for the B and L counter which accepts light through a much larger solid angle. Experiments were also performed which showed that high concentrations of subcountable-sized monodispersed DOP aerosols (e.g., 10^4 per cc of 0.25 micron) generated a relatively monodispersed distribution of pulses within the counting range. (Authors' Abs.)

V. CONTROL METHODS

347
Ayen, R. J. and T. Yonebayashi.
CATALYTIC REDUCTION OF NITROGEN DIOXIDE BY CARBON MONOXIDE. Atmos. Environ., v. 1: 307-318, May 1967.

Rate data for the catalytic partial reduction of nitrogen dioxide with carbon monoxide were obtained using a flow reactor operated differentially at atmospheric pressure and at temperatures of 180-240°C. A barium-promoted copper chromite catalyst was used. Nitrogen dioxide and carbon monoxide partial pressures were varied from 0.02 to 0.12 atmospheres using helium as a diluent to bring the total gas flow to 4000 ml/min or a space velocity of 50,000 hr^{-1}. Under these conditions, the only important reaction products were nitrogen monoxide and carbon dioxide. Changes in reactant concentrations had significant effects on the chemical nature of the catalyst. Nitrogen dioxide appeared to be strongly adsorbed on the catalyst surface. Increasing NO_2 partial pressure caused the reaction rate to decrease. The rate increased approximately linearly with increasing partial pressure of CO, suggesting that the adsorption of CO was the controlling step in the reaction. (Authors' Abs.)

348
Bradley, D. W.
FABRICATION TECHNIC FOR LIMITING ORIFICE OF GLASS FOR AIR FLOW CONTROL. Chemist-Analyst, v. 55: 93, July 1966.

A simple inexpensive device needed for the control of air at a small flow rate (0.3 liter per min) through a bubbler containing glacial acetic acid as an absorbing liquid is fabricated by inserting a steel stylet of appropriate diameter into a length of glass tubing, one end of which has been softened, and closing that end by heating. The stylet is subsequently dissolved in aqua regia. The orifice diameter secured depends on the diameter of the stylet selected. (APCA Abs.)

349
Clark, W. E., D. N. Hess, P. D. Neumann and others
LABORATORY DEVELOPMENT OF PROCESSES FOR FIXATION OF HIGH-LEVEL RADIOACTIVE WASTES IN GLASSY SOLIDS. IV. CORROSION STUDIES ON CANDIDATE MATERIALS OF CONSTRUCTION. Atomic Energy Comm., Oak Ridge National Lab., Tenn., 1967, 37p. (USAEC-ONRL-3816)

Laboratory test results indicate that austenitic stainless steels, particularly type 304L, can be used as the solidification and storage vessel for the calcination and, with caution, the melting to form a glass or a ceramic solid of Al containing (TBP-25) and sulfate containing (Purex) waste types. Temperatures of operation should be kept < 900°; waste and additive compositions must be known, and operational control must be good in order to avoid corrosion difficulties. Corrosion during storage in a salt mine should be no problem provided the salt is relatively dry. The Ti was superior to the stainless steels and to the Ni alloys for service in a waste evaporator and its condenser. Both stainless steel and nickel alloys developed intergranular attack, which was accelerated by the presence of fission product quantities of Ru. The presence of appreciable concentrations of uncomplexed fluoride would be expected to increase the corrosion of all these alloys markedly, but its effect on Ti would be proportionally greater. (Chem. Abs.)

350
Dey, H. F., W. L. Polgase and M. F. LeDuc
CONTROL EQUIPMENT FOR GASES AND VAPORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson, Cincinnati, Ohio, Public Health Service, National Center for Air Pollution, 1967, p. 171-232. (PHS Publ. No. 999-AP-40)

Five methods utilizing air pollution control equipment for gases and vapors are discussed. Both the direct fired and catalytic afterburners are effective; the direct fired one requires high temperatures and adequate ventilation, the catalytic type functions at a lower temperature and because of possible lower fuel costs may be less expensive in the long run. Adsorption (in which molecules of a fluid contact and adhere to the surface of a solid) may be used to remove air contaminants in a fluid. In the case of a gas or vapor the contaminant may be condensed out. In the more special case of a contaminated gas absorption may be utilized. In gas absorption, one or more constituents are removed from a gas stream by dissolving them in a selective liquid solvent.

351
Gross, A. J. and N. Mantel
THE EFFECTIVE USE OF BOTH POSITIVE AND NEGATIVE CONTROLS IN SCREENING EXPERIMENTS. Biometrics, v. 23: 285-295, 1967.

In the experimental screening of anti-cancer agents, it is common to employ two control groups. These are, an untreated negative control group, and a group treated with a standard effective agent, the positive control group. In this paper the problems of animal allocation to the two control groups and estimation of drug effects, taking data for both groups into account, are considered using a minimum variance criterion. The rationale for the use of both types is discussed. (Authors' Abs.)

352
Harkness, A. C.
WET OXIDATION OF CARBON MONOXIDE FOR PURIFICATION OF GAS STREAMS. U.S. Patent 3,383,164 (Cl. 23-2).
May 14, 1968, 3p.

The title process, effective at ambient temperatures passes the gas through a scrubber or solution containing acidified (with $HClO_4$ or H_2SO_4, pH <7) alkali permanganate which contains a catalytic amount of Ag^+ or Hg^{++}, the concentration of which can be as low as that afforded by AgCl. Ag^+ is more effective than Hg^{++}. Used solution is filtered to remove precipitated MnO_2, the MnO_4 content is replenished, and the solution is returned to the process while the purified gas stream can be vented to the atmosphere. The method is useful in analytical procedures or for purifying the exit gas from catalytic hydrogenation. (Chem Abs.)

353
Katz, J. and W. A. Verrochi
A FILTER TEST METHOD FOR RAPID WEIGHT DISTRIBUTION OF DUST IN GAS STREAMS TO EVALUATE DUST COLLECTORS.
Jour. Air Poll. Control, v. 18: 401-402, June 1968.

The purpose of this paper is to describe a simple gravimetric test method that was used as a field tool to diagnose variations and malfunctions in dust collector performance. This method is not considered a replacement for accepted standard test methods for stacks. Nevertheless, the reproducibility ease, and value of this short term monitor test method over a two year period, covering over 1000 tests suggest that this method may be used effectively in the field. (Authors' Abs.)

354
Kawahara, F. K., J. W. Eichelberger, B. H. Reid and others
SEMIAUTOMATIC EXTRACTION OF ORGANIC MATERIALS FROM WATER. Jour. Water Poll. Control Fedr., v. 39: 572-578, 1967.

A semiautomatic apparatus for rapid and simultaneous liquid-liquid extractions of organic compounds from water without removal of the water from the sample bottle has been devised. The method consists of placing a special cylindrical impeller having inlet and outlet ports in an ordinary sample bottle and adding organic solvent. The vertical vortex created by the impeller draws the organic solvents into the impeller, which then expels the solvents as bubbles which rise, collect on the surface, and recirculate. Optimum solvent volume is about 100 ml. The study also determined the most suitable extracting solvent, and efficiency and constancy of extraction. The apparatus permits extraction of chlorinated hydrocarbons from water with efficiencies of up to 95%. (Authors' Abs.)

355
Kitani, S.
[AEROSOL IN NUCLEAR SAFETY - COLLECTING CAPABILITY OF AEROSOL FILTER] Genshiryoku Kogyo (Tokyo), v. 13: 21-26, Feb. 1967.

The problem of handling atomic aerosols lies in the fact that they have no odor, are hard to detect, and have a very low maximum allowable concentration. For example, the maximum allowable concentration of Pu^{239} is 2.2×10^{-8} ppm compared to 0.1 to 0.5 ppm for SO_2. Uranium oxide is generated in uranium refining and processing, the size of the particle depending upon the process. The dispersion of PuO_2 causes problems in various plutonium production processes. Non-radioactive aerosols become radioactive by absorbing the radioactive particles. The cascade impactor has been widely used for sampling particles in the 1 to 20-micron range. Since the particles have an inclination to move from higher to lower temperature, this principle is used to collect particles smaller than 5 micron with 100% efficiency. The smaller the thermal conductivity of the particle, the higher the collecting efficiency. Electrostatic precipitation and centrifugal methods of collection are described. In an efficiency comparison between electrostatic and filter methods of collection, for beta-rays the methods are about the same, but for x-rays, the filter method is better. The filter method is better because the radioactive aerosol concentration is small. Methods of aerosol generation are described, including chemical and physical methods, and concentration and spray methods for generating liquid aerosols. An investigation of the sedimentation velocity of particles is also mentioned as a means of particle size measurement. (APTIC Abs.)

356
Kitani, S. and K. Homma
RETENTION EFFICIENCY OF AIR FILTERS.
Jour. Colloid and Interface Sci., v. 24: 270-271, 1967.

An experimental design for the measurement of aerosol penetration through an air filter, with a Shibata Digital Dust indicator for the determination of concentration, is given. Dioctyl phthalate and NaCl aerosols have the same penetration if the particle size and flow rate are the same. The higher the particle size, the lower is the penetration. (Chem. Abs.)

357
Mehta, D. S. and S. Calvert
GAS SORPTION BY SUSPENSION OF ACTIVATED CARBON IN WATER. Environ. Sci. and Technol., v. 1: 325-331, Apr. 1967.

Gas scrubbing by suspensions of adsorbent particles in liquids offers the advantages of high capacity, fluid handling, and inexpensive solvent losses. The results of adsorption capacity for carbon dioxide, butane, and propane are reported and also the mass transfer efficiency for carbon dioxide, methane, propane, butane, n-hexane, ethylene, trichloroethylene, benzene, toluene, butyl alcohol, amyl alcohol, and acetone sorption. Solubility of the transferring component in water is the major factor affecting transfer rate. (APCA Abs.)

358
PETROLEUM EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District; County of Los Angeles. Ed. by J. A. Danielson, Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control. 1967, p. 561-678. (PHS Publ. No. 999-AP-40)

Petroleum industry operations can be divided into production, refining, and marketing. Production includes locating and drilling oil wells, pumping and pretreating the crude oil, recovering gas condensate, and stripping these raw products to the refinery or, in the case of gas, to commercial sales outlets. Refining includes oil refining and the manufacture of various chemicals derived from petroleum. Marketing involves the distribution and the actual scale of the finished products. These activities and their sources of air pollution are discussed thoroughly and adequate air pollution controls are recommended. (Authors' abstract modified)

359
Shleien, B., J. A. Cochran and A. G. Friend
CALIBRATION OF GLASS FIBER FILTERS FOR PARTICLE SIZE STUDIES. Amer. Indus. Hyg. Assoc. Jour., v. 27: 353-359, July-Aug. 1966.

The collection efficiency of selected glass-fiber filters was determined by using homogeneous latex sphere, oleic acid, and uranine test aerosols having aerodynamic equivalent diameters ranging from 0.1 to 2.7 μ. Variations in field sampling that might cause changes in collection efficiency are discussed; results with theoretically calculated retentivities based on interception, inertial impaction, and diffusion parameters are compared. (APCA Abs.)

360
Spaite, P. W. and R. E. Harrington
ENDURANCE OF FIBERGLAS FILTER FABRICS. Jour. Air Poll. Control Assoc., v. 17: 310-313, May 1967.

A study was made to determine the effect of production process variables on fiberglass filter life in an accelerated endurance test at high temperatures. Tests were conducted in a unit designed to provide conditions simulating those encountered in field use. Test variables investigated included filtering temperature, fabric finish, bag tension, and aging at elevated temperatures. The relative effect of these variables is discussed with respect to the endurance of four commercially available, filtration fabrics. (Authors' Abs.)

361
Stewart, W. S. and W. E. Barr
CONTROL SYSTEM FOR MAXIMUM HEAT UTILIZATION IN PROCESS FOR FLUID CATALYTIC DECOMPOSITION CONVERSION OF HYDROCARBONS. U.S. Patent 3,316,170 (Cl. 208-164). Apr. 25, 1967, 4p.

A flowsheet and appropriate mathematics are given for control of a catalytic cracking reactor-regenerator system. The predicted catalyst bed level is linearly related to conversion, temperature and the flow rates of light and heavy cycle oils from the main fractionator. The rate of withdrawal of spent catalyst responds to the difference between predicted catalyst bed level and the actual bed level. The rate of withdrawal of regenerated catalyst is proportional to the temperature in the dense phase, which is desired to be kept constant. (Chem. Abs.)

362
Taheri, M. and S. Calvert
REMOVAL OF SMALL PARTICLES FROM AIR BY FOAM IN A SIEVE-PLATE COLUMN. Jour. Air Poll. Control Assoc., v. 18: 240-245, Apr. 1968.

Particle collection by foam produced on sieve plate apparatus was studied in a 3 x 3 in. sq column and in a 2 in diam circular column. Experimental data have been obtained for silica test dust, glass beads, sulfur aerosol, polystyrene beads, and extensively for methylene blue aerosol. A new technique utilizing the Goetz aerosol spectrometer was developed and was used to obtain the collection efficiency as a function of particle diameter. A correlation was developed based on inertial mechanism. In this correlation the collection efficiency is expressed as a function of inertial parameter and foam density. The pressure drop in the operating range varied from 2 to 4 in of water. (Authors' Abs.)

(a) Industrial

363
Bienstock, D., J. H. Field, and J. G. Myers.
PROCESS DEVELOPMENT IN REMOVING SULFUR DIOXIDE FROM HOT FLUE GASES, PART 3. Bureau of Mines, Coal Research Center, Pittsburgh, Pa., July 1967, 58p. (Report on Investigations No. 7021).

The use of alkalized alumina in removing sulfur dioxide from a coal combustion flue gas at 625°F was investigated on a pilot plant scale. The absorber was 26 ft long and 1.6 in ID. Counter current gas-solids flow at gas velocities of 8 to 15 ft/sec in the presence and absence of baffles, as well as solids entrainment at gas velocities of 20 to 23 ft/sec with solids recycle, were employed. The spent absorbent was regenerated as a fixed bed with the reducing gases--reformed natural gas and hydrogen. Twenty cycles of absorption-regeneration were successfully completed using the alkalized alumina rolled into spherical granules 10 to 16 mesh. There was no loss in activity of absorbent toward SO_2 with a modest attrition equivalent to 0.1% of the solids feed. Supporting studies were conducted on the effect of the sodium content in the absorbent, the composition of the reducing gas, thermal treatment to increase absorbent hardness, and removal of absorbed chlorine from the absorbent. A mathematical model was formulated to describe the removal of SO_2 by alkalized alumina from fixed and falling beds. (Authors' Abs.)

364
Cederlof, R., M. L. Edfors, L. Friberg, and others.
ON THE DETERMINATION OF ODOR THRESHOLDS IN AIR POLLUTION CONTROL: AN EXPERIMENTAL FIELD STUDY ON FLUE GASES FROM SULFATE CELLULOSE PLANTS.
Jour. Air. Poll. Control Assoc., v. 16: 92-94, 1966.

From the hygienic point of view, not only the health hazards caused by air pollutants but also the odor from emitted flue gases should be reduced to a minimum. An effective control of the risk of odor at ground level presupposes knowledge of the source concentration of the odoriferous gas as well as its odor threshold. This threshold has to be estimated empirically, as the flue gases often contain a complex mixture of different odoriferous substances, the odor thresholds of which are in most cases unknown. For this purpose a method has been developed for estimating the odor thresholds of flue gases emitted from different industrial processes. The method, a field method, is based on an exposure procedure, a number of subjects compare different concentrations of the flue gas with samples of fresh air and decide at what concentration the flue gas is no longer noticeable. The gas samples used are neither compressed, nor absorbed or heated before the exposure test. The method has been used in two studies on gases from Swedish sulfate cellulose plants. In order to estimate the effect on the odor threshold of different deodorizing measures, gas samples were taken not only from the stack but also from different phases in the production process. The results and a brief discussion on the practical applications of the method are given. (Authors' Abs.)

365
Cederlof, R., L. Friberg, and T. Lindvall.
THE ORGANOLEPTIC EVALUATION OF ODORS WITH SPECIAL REFERENCE TO THE KRAFT PULP INDUSTRY. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, Apr. 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n. d., p. 111-140.

Two different principles are described for the evaluation of odors: (1) determination of an odor threshold and (2) odor observations in ambient air. There are plans to conduct a comparative study in the vicinity of a sulfate plant to discover the extent of agreement between the two approaches.

366
CHEMICAL PROCESSING EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Serivce, National Center for Air Pollution Control, 1967, p. 681-806. (PHS Publ. No. 999-AP-40).

Details of the air pollution problem and controls associated with the following: resin kettles, varnish, cookers, sulfuric acid manufacturing, phosphoric acid manufacturing, paint baking ovens, soaps and synthetic detergents, glass manufacture, frit smelters, food processing equipment, fish canneries and fish reduction plants, reduction of inedible animal matter, electroplating, insecticide manufacture, hazardous radioactive material, oil and solvent re-refining, and chemical milling are presented.

367
Connelly, J. J., V. G. Vely, W. H. Mink, and others.
STUDIES ON IMPROVED RECOVERY OF PROTEIN FROM RENDERING-PLANT RAW MATERIALS AND PRODUCTS. III. PILOT-PLANT STUDIES ON AN ENZYME HYDROLYSIS PROCESS. Food Technol., v. 20: 125-130, 1966.

The enzyme hydrolysis process for recovering protein from rendering-plant raw materials was scaled up to a pilot-plant operation. Approximately 3000 lb of raw material (shop fat and bone) is ground, water is added to give a ratio of raw material to water of 2:1, the mixture is heated to 180°F with agitation to inactivate any enzyme action and cooled to 122°F. A fungal proteolytic enzyme is added, and agitation is continued for two hours at 122°F. The temperature is then raised to 190°F to inactivate the enzyme, followed by separating a bone fraction with a scroll-type solid-bowl centrifuge, and tallow, protein and water, and sludge fractions with a disk-type liquid-liquid centrifuge. The sludge fraction is recycled to the enzyme hydrolysis reaction vessel. The protein and water fraction is then pumped to a dryer feed-holding tank and then to a spray dryer. A number of runs show that it is possible to produce a dry protein product analyzing 74% protein, 7% fat, and 6% ash. The amino-acid profile of the protein was similar to that reported previously. Salmonellae could not be detected in the final product, and total counts and coliform counts were within acceptable levels for products of this type. Previous estimates of likely operating costs based on laboratory data were confirmed in the pilot-plant operation. (Authors ' Abs.)

368

DESIGN OF LOCAL EXHAUST SYSTEMS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Public Health Service, National Center for Air Pollution Control, 1967, p. 25-87. (PHS Publ. No. 999-AP-40).

Exhaust systems are devices used to capture dusts and fumes or other contaminants at their source and prevent their discharge into the atmosphere. Close-fitting hoods are used to capture the contaminants from one or more locations so that the laden gases can be conveyed through a system of ducts by one or more exhaust fans. An air pollution control device can then collect the air contaminants and discharge the cleansed air into the atmosphere. Fluid flow is discussed due to its usefulness in analyzing the ventilation needs and in selecting the hooding device. Hood, duct, and fan design are examined and vapor compressors, checking an exhaust system and the cooling of gaseous effluents are described.

369

Deurbrouck, A. W.
PREPARATION CHARACTERISTICS OF COAL FROM RANDOLPH COUNTY, WEST VIRGINIA. Bureau of Mines, Coal Research Center, Pittsburgh, Pa., 1966, 30p. (Report on Investigations No. 6874).

In this Bureau, 1.25%S and 8.0% ash are used as the standards to determine whether coal is suitable for metallurgical coke. Coal with more than these amounts may be used for making coke when blended with low-S or low-ash coals. Of 13 samples collected from 3 beds, the Lower Kittanning samples were of high-ash and medium-S content, and were not amenable to upgrading. Samples of the Peerless bed were of metallurgical quality as received or they were easily upgraded. (Chem. Abs.)

370
Field, J. H., R. C. Kurtzrock and D. N. McCrea
HOW TO PREVENT SO_2 EMISSION. Chem. Eng.,
v. 74: 158-160, 1967.

A new absorption process for the removal of sulfur dioxide from flue gases has been developed. The process consists of contacting the flue gases against an "alkalized alumina" absorbent that reacts with SO_2, thus removing it from the gas stream going to atmosphere. The absorbent medium is a co-precipitate of sodium and aluminum oxides. Absorption involves the oxidation of SO_2 and its subsequent reaction with the metal oxide to form the sulfate. The spent absorbent is regenerated by contacting it with a reducing gas. Held on the absorbent as the sulfate, sulfur is reduced to H_2S and carried off as part of the regenerator effluent. The latter is then processed for recovery of elemental sulfur. The absorber is designed for 90% removal of total sulfur in flue gas. This alkalized alumina process removes SO_2 without reducing the flue gas temperature therefore increasing heat-recovery efficiency. The absorbent contacting method for the removal of sulfur dioxide from flue gases has a low pressure drop and is flexible in its range of gas velocities, absorbent particle size and utilization. Its operating costs are also low because the process makes a valuable byproduct, elemental sulfur. (APTIC Abs.)

371
Galeano, S. F. and C. I. Harding
SULFUR DIOXIDE REMOVAL AND RECOVERY FROM PULP MILL POWER PLANTS. Jour. Air Poll. Control Assoc.,
v. 17: 536-539, 1967.

The use of soda ash liquor to scrub SO_2 rich power plant flue gases was studied using an Airetron pilot scrubber with a maximum capacity of 3000 cfm. The relative effects of the major operating variables-temperature, soda ash concentration, and the gas/liquid flow ratio- on the absorption phenomenon were determined. Orthogonal factorial experiments were used to derive a response function relating mass transfer values to operating variables. The economics of a full scale NSSC [neutral sulfite-semichemical process] installation are discussed. (Authors' Abs.)

372
Gartrell, F. E.
CONTROL OF AIR POLLUTION FROM LARGE THERMAL POWER STATIONS. Revue de la Societe Royale Belge des Ingenieurs et des Industriels (Bruxelles), No. 11: 471-482, 1966.

A discussion is given of measures for removal of particulates from stack gases and reductions in SO_2 emissions, dispersion of emissions by high stacks, and control by operational procedures. Results of air pollution monitoring near large power stations of the TVA are reviewed. Of the various emissions, particulates and S compounds require the major attention. The N oxides produced in some special situations may react photochemically with hydrocarbons to produce important air pollutant compounds. Information on air pollutant emissions from power plant furnaces using gas, coal, and fuel oil with different furnace types is reviewed. Particulates are removed from stack gases by mechanical or centrifugal-type collectors, electrostatic precipitators, and in one case by a bag filter installation. Modern gas cleaning systems have been perfected to remove up to 99.5% of the original ash content of the coal but costs increase rapidly above the 95% removal level. High efficiency gas cleaning systems often are combinations of mechanical and electrostatic collectors. In recent years much research effort has been made to develop means for removal of S from fossil fuels or for removal of S compounds from stack gases. These developments are reviewed. At present no process has been sufficiently proved as a primary method for SO_2 air pollution control for large power plants. The long term air pollution investigations in the vicinity of the TVA power plants are reviewed. Meterological studies and SO_2 autometer data are correlated. The operational controls that TVA has used to reduce emissions are the use of low-S coals, load reduction during unfavorable meteorology, chemical removal of SO_2 by limestone injection, and raising stack gas temperatures to increase plume rise. (Chem. Abs.)

373
Gartrell, F. E. and J. C. Barber
POLLUTION CONTROL INTERRELATIONSHIPS.
Chem. Eng. Progr., v. 62: 44-47, 1966.

TVA experience with coal-fired power plants and phosphate fertilizer plants demonstrate that air pollution control and water pollution control in industrial applications are closely related. The application of one type of control must ultimately include the other. Examples are given from the major facilities of the TVA Authority. (Chem. Abs.)

374
Gerstle, R. W. and R. F. Peterson
CONTROL OF NITROGEN OXIDE EMISSIONS FROM NITRIC ACID MANUFACTURING PROCESSES. Air Eng., v. 9: 24-28, 34, Apr. 1967.

The manufacture of nitric acid and the control of resulting atmospheric emissions are the subjects of the article. The ammonia oxidation process, abatement methods and equipmentfor nitrogen oxides are several of the topics discussed. (Authors' Abs.)

375
Gruhler, J. F. and K. Flieger
METHODS FOR ELIMINATING HYDROGEN SULFIDE FROM SEWAGE. Wasserwirtschaft - Wassertechnik (Berlin), v. 17: 381-384, 1967.

Different methods are reviewed. The aeration of the water and subsequent removal of H_2S from the air by reaction with $Fe(OH)_2$ or Fe_2O_3 (bog iron ore) are technically and economically feasible. It is usually preferable to treatment with Cl. (Chem. Abs.)

376
Hangebrauck, R. P. and P. W. Spaite
CONTROLLING THE OXIDES OF SULFUR. Jour. Air Poll. Control Assoc., v. 18: 5-8, Jan. 1968.
(Presented at: 6th Annual Sanitary and Water Resources Engineering Conf., Nashville, Tenn., June 1967.).

Studies of the sources of sulfur oxides pollution show that combustion of fossil fuels is responsible for 78% of the total emissions to the atmosphere; the remaining 22% comes from other industrial operations, which represent more than 22% of the pollution problem in terms of severe local nuisances and high ground-level concentrations. The great diversity in types and sizes of all sources requires an entire spectrum of approaches for control. The possible approaches to control are categorized to include the desulfurization of coal, desulfurization of residual fuel oil, process modification, and desulfurization of flue gas. Work on specific possibilities in each of these categories is underway both in the federal government and in industry. (APTIC Abs.)

377

Harding, C. I. and J. E. Landry
FUTURE TRENDS IN AIR POLLUTION CONTROL IN KRAFT PULPING INDUSTRY. Tappi, v. 49: 61A-67A, Aug. 1966.

The reasons for mounting pressure on the kraft industry to reduce atmospheric emissions are reviewed. Measured gaseous and particulate emission figures together with recent advances in emission control technology are a basis for proposing types and extent of emission control to be utilized during the next five years. (Eng. Index)

378

Harkness, A. C., F. E. Murray and L. Girard
CATALYTIC OXIDATION OF SULFUROUS AIR POLLUTANTS. Atmos. Environ., v. 2: 303-320, July 1968.

The sulfurous air pollutants, methyl mercaptan, methyl sulfide, methyl disulfide and hydrogen sulfide have been oxidized to sulfur dioxide. The efficiency of various catalysts has been compared by a microreactor technique. The effect of temperature of the conversion and product distribution over selected catalysts has been determined. (Authors' Abs.)

379

Harrington, R. E., R. H. Borgwardt and A. E. Potter
REACTIVITY OF SELECTED LIMESTONES AND DOLOMITES WITH SULFUR DIOXIDE. Amer. Indus. Hyg. Assoc. Jour., v. 29: 152-158, 1968.

Limestones and dolomites with both high and low levels of Ca, Mg, and Fe, screened to a -10 + 28 mesh were calcined in a rotary kiln for 1, 2, and 3 hrs. Flue gas containing 1800 ppm of SO_2 was passed through a 5/8 inch deep fixed bed of calcined stone at 1400-1900°F at 2.9 ft /sec with a residence time of 0.02 sec. The outlet gas was continuously monitored for SO_2 with an ir analyzer. The stone capacity, defined as the quantity of SO_2 reacted at the time when 20% of the inlet SO_2 passes through the bed, was selected as the basis for comparing test limestones. The reactivity of the individual samples varied with calcination time, calcination temperature and reaction temperature. However, the variations in reactivity among the various test materials were greater and more significant than the calcining variables. No correlation was found between differences in chemical composition and reactivity. Physical properties of the reactant materials such as crystal structure, surface area, or pore size appeared more important than chemical composition. The utilization of limestone or dolomite for the removal of SO_2 from flue gas may be economically feasible. (Chem. Abs.)

380
Jensen, G. A., D. F. Adams and H. Stern
ABSORPTION OF HYDROGEN SULFIDE AND METHYL MERCAPTAN FROM DILUTE GAS MIXTURES. Jour. Air Poll. Control Assoc., v. 16: 248-251, May 1966.

The absorption of hydrogen sulfide and methyl mercaptan by aqueous solutions of chlorine, sodium hydroxide, and chlorine plus sodium hydroxide was studied using a 2 in diameter absorption column packed with 1/4 inch Intalox saddles. Absorption rates were noticeably affected by chemical reactions occurring in the aqueous chlorine and hydroxide media. These solutions were studied as a means of controlling sulfur--containing gas emissions from kraft paper mills. The absorption studies indicated that aqueous chlorine solutions at a pH above 12 were effective absorbents for hydrogen sulfide removal in absorption equipment designed to tolerate sulfur in suspension. The absorption of methyl mercaptan in aqueous chlorine solutions appeared to be impractical since dimethyl disulfide was apparently the only product formed and was stripped from the tower by the gas stream. Sodium hydroxide solution was an effective absorbent for both methyl mercaptan and hydrogen sulfide when hydroxide to sulfide or mercaptan feed ratios were greater than 1 or 1.8, respectively. The mercaptan absorption coefficient was approximately twice that for sulfide absorption. (Authors' Abs.)

381
Katell, S.
REMOVING SULPHUR DIOXIDE FROM FLUE GASES. Chem. Eng. Progr., v. 62: 67-73, Oct. 1966.

An economic evaluation of new methods for removing sulfur dioxide from power plant flue gases is presented. Considered are processes under development or proposed for development in the United States. Capital and operating costs are established, and these costs are expressed as dollars per kilowatt of installed capacity, dollars per ton, and cents per million Btu of coal fired. (Air Poll. Abs.)

382
Katell, S. and K. D. Plants.
HERE'S WHAT SO_2 REMOVAL COSTS. Hydrocarbon Processing, v. 46: 161-164, July 1967.

Cost estimates are obtained for three processes in which SO_2 is removed from stack gases at 220°F by hot solid absorbtion. These three processes are as follows: (1) alkalyzed alumina which requires the lowest capital investment and operating costs, (2) Catalytic oxidation which requires the highest capital investment and intermediate operating cost (about 15% higher than alkalyzed alumina), and (3) the Reinluft process using activated char which requires an intermediate capital investment and the highest operating cost of the three processes. The study is based on a power plant producing 800 Mw of power and using coal containing 3% sulfur.

383
Kiyoura, R.
STUDIES ON THE REMOVAL OF SULFUR DIOXIDE FROM HOT FLUE GASES TO PREVENT AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 16: 488-489, 1966.

The pollution of the atmosphere by sulfur dioxide is one of the gravest public nuisance problems, especially in the industrial regions. A practically applicable method in industry for the removal of sulfur dioxide has been studied. The Kiyoura-T. I. T. process utilizes the oxidation method to convert SO_2 in the presence of vanadium oxide. A limited amount of water vapor present in the flue gas reacts with SO_3 to form H_2SO_4. Ammonia is then introduced to the gaseous mixture, which is now at the suitable temperature, to form ammonium sulfate. Conditions are controlled to produce ammonium sulfate of the right size to produce aggregate that may be removed by a dry cyclone separator. (Author's Abs.)

384
Ludwig, J. H. and P. W. Spaite.
CONTROL OF SULFUR OXIDE POLLUTION. Chem. Eng. Progr., v. 63: 82-86, June 1967.

Special attention is given to both present and projected socioeconomic factors as well as chemical engineering problems associated with the various routes suggested for containment of sulfur oxide pollution within tolerable limits. The control of sulfur oxide pollution from combustion of fossil fuels is worldwide and is the most critical air pollution problem facing modern society. (Eng. Index)

385
Maahs, H. G., L. N. Johanson, and J. L. McCarthy.
SEKOR. III. PRELIMINARY ENGINEERING DESIGN AND COST ESTIMATES FOR STEAM STRIPPING KRAFT PULP MILL EFFLUENTS. Tappi, v. 50: 270-275, 1967.

An illustrative preliminary engineering design and cost estimate was carried out relative to the SEKOR-B (refluxed column) process. As a basis for such calculations, experimental determinations were made of vapor-liquid equilibrium constants for the S-containing components MeSH, Me_2S, and Me_2S_2 in dilute concentration in water of 1 atmosphere total pressure; and also for the substances limonene, α-pinene, and α-terpineol, which are major constituents of the recovered volatile oil. All substances are of higher volatility than water and can be steam-stripped, and -terpineol and Me_2S_2 are the most difficult to strip from water. The optimum feed/steam ratio, reflux rate, and number of stages required to strip H_2S and the above components from condensates of a 400 ton/day kraft pulp mill were calculated. (Chem. Abs.)

386
MECHANICAL EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 325-420. (PHS Publ. No. 999-AP-40).

A large number of air pollution sources including, among others, hot-mix asphalt paving batch plants, concrete-batching plants, cement-handling equipment, feed and grain mills, and and zinc-galvanizing equipment are discussed in detail. The air pollution sources are analyzed with reference to the raw materials used, basic equipment, plant operation, type of air pollution problem, hooding and ventilation requirements and air pollution control equipment.

387
Miller, M. R. and H. J. Wilhoyte.
A STUDY OF CATALYST SUPPORT SYSTEMS FOR FUME-ABATEMENT OF HYDROCARBON SOLVENTS. Jour. Air Poll. Control Assoc., v. 17: 791-795, Dec. 1967. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967).

In a stainless steel pilot plant system, operating with combined thermal incineration and catalytic oxidation, studies have been made of the influence of catalyst-support geometry on abatement efficiency. Catalyst supports tested were ceramic spherical pellets, metal foils and ceramic honeycomb structures, all with precious metal catalyst. Data obtained cover a range of space velocities from 30,000 to 175,000 scf/hr - cu ft bed and a range of catalytic reactor temperatures from 150 to 450 degrees C. Results show that optimum fume-abatement performance is obtained by combining incineration and catalytic oxidation and that catalyst support geometry has a significant effect on performance. (Authors' Abs.)

388
Murray, F. E.
THE OXIDATION OF KRAFT BLACK LIQUOR. Pulp and Paper Magazine of Canada (Gardenvale, Que.), v. 69: 82-86, 1968.

Current knowledge of the oxidation of kraft black liquor prior to evaporation and burning is summarized. Topics considered briefly include the mechanism, catalysis, and kinetics of oxidation, air pollution and economic aspects of black liquor oxidation, and oxidation equipment. One recorder chart is reproduced to show that the loss of H_2S from evaporators can be greatly reduced if the liquor is completely oxidized before evaporation. During the oxidation period, the emission of H_2S with the stack gases was 50-60 ppm ; but when oxidation was discontinued, the H_2S content increased to 600 ppm. (Chem. Abs.)

389
Perry, H. and J. H. Field.
AIR POLLUTION AND THE COAL INDUSTRY. Trans. AIME, v. 238: 337-345, Dec. 1967.

A short review of the legislation enacted in the United States to combat air pollution from the production and combustion of coal is presented. The nature and magnitude of air pollution problems affecting the mining, preparation, cooking and combustion of coal are discussed and the methods available for the reduction of these emissions, particularly during cooking, are described. Tabulated data show the range of emissions from combustion of bituminous coal is pulverized fuel or cyclone furnaces and the generation of sulfur oxides in the combustion of coal. Means of combatting particulate emission by the use of mechanical separators and electrostatic precipitators are discussed. Present-day collection equipment can be designed for specified conditions, so as to remove at least 99% of solids from the gases. Proposed methods to meet the problem of gaseous emissions currently receiving considerable attention are described, with special emphasis on methods to decrease pollution by sulfur oxides. The possible, but not always practical, methods for the reduction of sulfur oxides are discussed. They include selective mining, coal preparation to remove pyrite sulfur, other physical or chemical methods for removing sulfur, improved combustion efficiency to decrease emissions per unit of energy, use of dolomite or other additives to the furnace, high stacks and wet and dry gas treating processes. (APTIC Abs.)

390
Potter, A. E., R. E. Harrington, and P. W. Spaite.
LIMESTONE-DOLOMITE PROCESSES FOR FLUE GAS DESULFURIZATION. Air Eng., v. 10: 22-27, 1968.

The use of limestone, dolomite, and their mixtures for flue-gas desulfurization is reviewed. Process chemistry and kinetics aspects include discussion of wet and dry systems, the calcination of the carbonates to oxides, contact between sorbent and flue gas, mass transfer of SO_2 to a reactive site in the carbonate particle, and reaction of the S oxide to a solid product. The engineering considerations include the furnace performance and its operability, the handling of waste and its disposal, the problem of plume reheat if wet carbonate is added, and the effect of carbonate addition on equipment corrosion. Current research in this field in various research organizations is described briefly. (Chem. Abs.)

391
Purdom, P. W.
SOURCE MONITORING. In: Air Pollution. v. II. Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 537-560.

Source monitoring is useful to plant management and operating personnel to control processes which may cause air pollution problems in the community. This may be supplemented by monitoring individual processes and raw materials. Systems relying on sensory perceptions are available for determining stack emissions and effects in the community. The tendency is towards the more expensive automated sampling, analysis, and recording of data. Source monitoring is practiced by control agencies to assure compliance with legal emission standards. Plant managements have used source monitoring to aid in correcting operating difficulties, and to provide a record for defense of the plant where emissions are carefully controlled within allowed limits. Control agencies may, in the future, require plants to maintain source monitoring systems and report data to the control agency. (Author's Abs., Modified)

392
Smith, R. G.
AIR POLLUTION—INSIDE PLANT IT'S WORSE. Consulting Engineer, v. 28: 166-169, Mar. 1967.

The importance of control of industrial environment in plants is discussed. Threshold limit values are the airborne concentrations of substances which have no adverse effect on workers and which must be adhered to in plants. Examples of shields, respirators, masks and ventilation methods used in various plants are presented. (Eng. Index)

393
Spaite, P. W.
REDUCTION OF AMBIENT AIR CONCENTRATIONS OF SULFUR OXIDES--PRESENT AND FUTURE PROSPECTS. In: Proc. 3rd Nat. Conf. Air Poll., Washington, D.C., 1966. Washington, D.C., Dept. of Health, Education and Welfare, 1967, p. 161-169.

Past, present, and prospective methods for the control of the sulfur oxides are discussed. Past and present processes can be categorized into three classes: (1) processes for high-efficiency removal of sulfur dioxide from process effluent streams (2) processes for removal of sulfur from coal, and (3) processes for removal of sulfur from residual fuel oil. These include desulfurization of flue gases, direct conversion of sulfur dioxide in flue gas to acid, metal oxide sorption, limestone-based process, char sorption, pyrite-coal combustion, desulfurization of coal, and desulfurization of residual fuels. The future can be discussed only in terms of the prospects for success of the needed work. What the status will be in the years ahead depends on the success of progress just now being developed. For the immediate future (say, until 1975) primary needs are: (1) to promote increased application of methods presently available for control of SO_x, and (2) to develop processes to assure that methods are available for control of as many of the different sources of sulfur-oxide pollution as possible. A reasonable projection into the future indicates that it will be beyond the year 2000 before levels are again reduced to what they are at the present time. (APTIC Abs.)

394
Squires, A. M.
AIR POLLUTION: THE CONTROL OF SO_2 FROM POWER STACKS. I. THE REMOVAL OF SULFUR FROM FUELS. Chem. Eng., v. 74: 260-268, 1967.

The problem of air pollution caused by emission of SO_2 from power-plant stacks is discussed. One method of reducing SO_2 emissions is to reduce the S content of the fuel. Processes for removing S from fuel oils and from coal are described. (Chem. Abs.)

395
Squires, A. M.
AIR POLLUTION: THE CONTROL OF SULFUR DIOXIDE FROM POWER STACKS. II. THE REMOVAL OF SULFUR DIOXIDE FROM STACK GASES. Chem. Eng., v. 74: 133-140, 1967.

Processes for the removal of SO_2 and SO_3 from power station stacks are discussed. Sulfur dioxide can be removed from hot flue gases by passing them through a bed of crushed limestone or dolomite, but equipment to accomplish this is bulky. Experiments on injecting raw dolomite into furnaces or flues have shown some promise, especially when the flue gases are passed through filters or scrubbers. Several other experimental systems for removing SO_2 are described. Sulfur trioxide tends to concentrate on particles of fly ash which are removed in electrostatic precipitators. However, SO_2 emissions can be controlled by adding divided MgO to fuel oil and operating with a minimum excess of air. Sulfur trioxide can also be removed by adding CaO or dolomite into flue gas just before passing gas through fiberglas bag filters. (Chem. Abs.)

396
Squires, A. M.
AIR POLLUTION: THE CONTROL OF SULFUR DIOXIDE FROM POWER STACKS. IV. POWER GENERATION WITH CLEAN FUELS. Chem. Eng., v. 74: 101-109, 1967.

The best prospects for "clean" power generation appear to lie in some type of two-stage combustion process, in which the 1st step would convert coal or residual oil into a gaseous fuel at high pressure. The gas would then be treated to convert its H_2S content to elemental S, which would be recovered as a by-product. The clean gas would then be used as fuel in power generation, in high-efficiency systems designed to take advantage of the cleanliness of the gas. (Chem. Abs.)

397
Squires, A. M.
CONTROL OF SULFUR DIOXIDE IN THE GAS DISCHARGE OF ELECTRIC POWER PLANTS. Acqua Industriale (Milano), v. 9: 13-15, 17-23, 1967.

The desulfurization of fuels before their use does not seem to be the most direct, rapid, and economic solution of the problem of escape of SO_2 from electric power plants. It has been estimated that between 1980 and 1990 breeder reactors may solve the problem since their production of energy/kg U is larger by a factor of 50 than present production. The elimination of the emissions of SO_2 from electric power plants can be conducted in 3 ways: (1) elimination of the S from the fuel before use; (2) elimination of the SO_2 after combustion; (3) combustion in two steps in which the second step utilizes the SH_2 from the first step. It has been established that it is not feasible to solve the problem by application of low-S fuel in plants equipped with very high stacks because not enough low-S fuel is available. For the same reason use of natural gas would not be possible for more extended periods. Also the world reserves of low-S liquid fuels are limited. Research for elimination of S from liquid fuels by catalytic hydrogenation has advanced considerably. Laboratories have achieved reduction of the S content at rates of 75-90% by hydrogenation under pressure and at elevated temperatures, S being produced as a by-product. The costs of the desulfurization plants are, however, as high as the cost of the corresponding refinery and for the power plants the additional costs per kw-hr may amount to 22-25 dollars. According to legal restrictions in New Jersey until 1971 desulfurization should be sealed down to 0.3% but this can be achieved only by doubling of the costs as compared with desulfurization to 1%S. In coal, dressing methods for separation of pyrite achieve yields of 50% but these methods cannot be applied where the pyrite is too finely subdivided. In the case of semicoke, desulfurization with H_2 at low temperature has been studied. Part of the S is easily separated and at sufficiently high concentrations. For pyrite-S the velocity of desulfurication speed is much lower and the H_2S gas concentrations attain only fractions of 1%. There is also a third part of S which cannot be removed at all by the process. For the formation of H_2S in desulfurization inside a bed of semicoke MnO_2 and calcined dolomite were studied. Desulfurization is carried out at 870° according to the reaction $(CaO/MgO) \quad H_2S \rightarrow (CaS + MgO) + H_2O$. Recovery is to be carried out at 425° together with steam and CO_2 according to the reaction $(CaS + MgO) + H_2O + CO_2 \rightarrow (CaCO_3 + MgO) + H_2S$. Calcination for regeneration of the dolomite is to be carried out at 870°, the conversion of the H_2S into S according to the Claus process. In the second reaction of temperatures of 485° and pressures of 15 atmospheres, the concentrations of the H_2S are sufficiently high for the Claus process. It has also been concluded that in the future the technology of coal should be directed to the conversion of its volatiles into valuable products while only the residual solid fuel should be used in electric power plants and for metallurgical purposes. (Chem. Abs.)

398
Squires, A. M.
DESULFURIZATION OF GAS. French Patent 1,420,350 (Cl. C 01b), Dec. 3, 1965, 5p.

A process for preparing H_2S is given in connection with the desulfurization of gas. Hydrogen disulfide gas is sorbed by a solid containing CaO/MgO to form CaS/MgO and H_2O. An apparatus is described for regenerating the CaS/MgO by treating with H_2O vapor and CO_2 to form $CaCO_3$/MgO and H_2S. The $CaCO_3$/MgO is converted into CaO/MgO by heating. (Chem. Abs.)

399
Squires, A. M.
AN INTRODUCTION TO THE TOP HEAT CYCLE. A MEANS FOR ELIMINATING SULFUR FROM POWER-STATION EFFLUENT WHILE IMPROVING HEAT RATE. Proc. Amer. Power Conf., v. 28: 505-515, 1966.

The top heat power cycle uses an O flame to heat steam directly to temperatures beyond those which may be reached by indirect transfer of heat from hot flue gases to steam. Fuel to the O flame should be clean and substantially free of S. Oxygen for the cycle can be produced by a conventional low-temperature plant. A description is given of equipment for a design with heavy residual oil, a survey is made of what the cycle might achieve, and development problems are discussed. The topics covered include: genesis of the cycle, description of the cycle, production of clean fuel gases, example of top heat cycle at 1500° F. with Kuwait heavy residue and low-temperature O, energy balance, heat exchange, equipment, purity of boiler feedwater, alternate method for O, and survey of the cycle's potential. (Chem. Abs.)

400
Squires, A. M.
PRODUCING HYDROGEN FROM CARBON MONOXIDE. U. S. Patent 3,355,249 (Cl. 23-213), Nov. 28, 1967, 4p.

A process is described for preparing H from CO and steam in fluidized beds of calcined dolomite. Thus, a gas mixture containing H 46.30, CO 25.05, CO_2 0.99, and H_2O 27.66 mole % was introduced into the bottom of a fluidized bed of partially reacted calcined dolomite from an upper bed. The bed was operated at 570 psia and 1500° F. Gaseous reaction products from the bed passed upwardly through a grate into a 2nd fluidized bed of calcined dolomite operated at 1100° F. The product gas from the 2nd bed contained H 96.29, CO 0.10, CO_2 0.01, and H_2O, 3.60%.

Spent calcined dolomite was withdrawn from the lower bed and regenerated by fluidized bed calcination under pressure. The 2 reaction beds are cooled by indirect heat exchange with H_2O and the heat can be used in power generation. Heat for power can also be recovered from the dolomite calcination off-gases. (Chem. Abs.)

401
Squires, A. M.
TOP HEAT CYCLE FOR CLEAN POWER. Chem. Eng. Progr., v. 62: 74-81, 1966.

Conventional Rankine cycle is topped internally by adding heat directly to high-pressure steam in the form of the products of combustion of a clean fuel with O. Hydrogen can be used as the fuel and it can be prepared by passing CO and steam over a bed of dolomite. H_2S impurity is removed on dolomite by formation of CaS. For this process to be effective, a way to recover S was developed by treating the solid CaS MgO with steam and CO_2 at high pressure. At 1000°F and 500 psi, a gas containing >50 mole % H_2S can be prepared. Sulfur-containing fuel can be used with no discharge of objectionable effluents. Economics of the top heat cycle for generation of electricity are discussed. (Chem. Abs.)

402
Sterling, M.
CURRENT STATUS AND FUTURE PROSPECTS FOR FOUNDRY AIR POLLUTION CONTROL. Public Health Service Publ. No. 1649, p. 254-259, 1966.

Existing technology is considered adequate to handle the problem. Cupola-collectors and electric induction or arc furnaces are indicated as equipment which will assist in ultimately solving the contamination problem in this field. (Chem. Abs.)

403
Sundaresan, B. B., C. L. Harding, F. P. May, and others.
ADSORPTION OF NITROGEN OXIDES FROM WASTE GAS. Environ. Sci. & Technol., v. 1: 151-156, Feb. 1967.

Experimental studies showed that commercial zeolite (molecular sieve) was more efficient than silica gel in removing low concentrations of nitrogen oxides from gas streams. Further studies proved that zeolite could effectively adsorb NO_x from waste gas streams in nitric acid plant. Adsorbed NO_x was recovered as enriched NO_x and HNO_3 by a regenerating bed at elevated temperatures with hot air and/or steam. Tests indicate that this system could be incorporated into an existing nitric acid plant, preventing release of significant quantities of NO_x into the atmosphere. (Eng. Index)

404
Walsh, R. T.
COMBUSTION EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 507-558. (PHS Publ. No. 999-AP-40).

Combustible hydrocarbons furnish man a versatile source of heat and convertible energy. When hydrocarbon fuels are burned gaseous oxidation products are formed and usually vented to the atmosphere. Gaseous and liquid fuels; gas and oil burners; and boilers, heaters, and steam generators all generate air pollution. Due to the hydrocarbon fuels, each presents a separate air pollution problem and suggests certain methods of control. The problems and control are discussed.

405
Wellman, P. and S. Katell.
HOT CARBONATE PURIFICATION COMPUTER PROGRAM. Bureau of Mines, Morgantown, W. Va., 1968, 25p. (U. S. Bureau Mines Inform. Circ., No. 8366)

The hot K_2CO_3 purification system developed by the Bureau is known worldwide as an economic system for removing CO_2 from industrial gases. A computerized version is given of the calculations used in determining the size and cost of equipment required for any hot carbonate purification system. The program is written in the FORTRAN IV language by using the WATFOR processor deck, prepared for use in an IBM 7040 system. With minor modifications the program could be used with any other compatible computer system. (Chem. Abs.)

(b) Non-industrial

406
AIR POLLUTION ENGINEERING MANUAL. AIR POLLUTION CONTROL DISTRICT: COUNTY OF LOS ANGELES. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 892p. (PHS Publ. No. 999-AP-40).

The control of air pollution emphasizing the practical engineering problems of design and operation at individual sources is discussed. The history of air pollution in Los Angeles County, the types of air contaminants, the design of air pollution control devices and the control of air pollution from specific sources are treated in detail.

407
Babinsky, A. D., and S. J. Derezinskl
WATER AND CARBON REMOVAL FROM CARBON DIOXIDE REDUCTION SYSTEMS. TRW Inc., TRW Equipment Lab., Cleveland, Ohio, 1966, p. 1-43 (U.S. Air Force Technical Document Report AMRL-TDR 66-83)

Methods suitable for use in a weightless environment for removing water and carbon from carbon dioxide reduction process systems were investigated. Water removal studies were conducted using a porous metal, plate-type, condenser-separator to remove the water from the exit gas streams of both Sabatier and Bosch type carbon dioxide reduction reactors. Water remaining in the effluent stream ranged from 0.97 to 2.08% by volume with the Sabatier reactor, and 0.78 to 0.92% with the Bosch reactor. A regenerative chemical dryer used to increase the reaction rate of the Bosch reactor, resulted in relatively minor changes in the reaction rate in steady state operation. Carbon flow pattern tests were conducted to determine design characteristics of a carbon separator-filter. A combination centrifugal separator and porous metal filter was used to remove carbon from the recycle flow stream and pass approximately 99% of the carbon to the carbon collector. Periodic back flow through the filter removes the remaining carbon from the filter. The Bosch reactor utilizes flat Fe catalyst plates stacked on a hollow rotating shaft. Carbon is dislodged from the rotating plates by carbon removal fingers projecting between the catalyst plates. Reaction gases flowing through the reactor carrying the carbon out of the reactor to the filter-separator. Filter clogging was observed due to continuence of the reaction in the filter element. Feasibility of water separation and carbon removal were demonstrated. Recommendations are made to improve long term operation of the carbon filter element. (Authors' Abs.)

408
Burgess, W. A. and D. E. Anderson.
PERFORMANCE OF RESPIRATOR EXPIRATORY VALVES. Amer. Indus. Hyg. Assoc. Jour., v. 28: 216-223, May-June 1967. (Presented at: Amer. Indus. Hyg. Conf., Pittsburgh, Pa., May 20, 1966)

A survey of the performance of expiratory valves used in air-purifying respirators is presented. Valves chosen for the study represented the four major valve design types in use in this country. Operating pressure, resistance to flow, and dynamic leakage were evaluated. The study of leakage included an investigation of the effects of valve orientation, covering, humidity, and work rate on dynamic leakage. Test results demonstrated significant differences in performance between valve types. (Authors' Abs.)

409
Burgess, W. A. and W. Nettleton.
AN IMPROVED AIR-PURIFYING RESPIRATOR.
Arch. Environ. Health, v. 16: 663-670, May 1968.

Toxic air contaminants in the occupational environment can be controlled by a number of engineering methods. Respiratory protective devices must be considered for use when the primary engineering controls are inadequate or impractical. Respirators suffer from serious performance limitations and their use must be critically reviewed before adoption for routine use. A design approach for air-purifying respirators to broaden their application base and enhance their value is presented. A device combining the features of air-purifying and atmosphere-supplying respirators is suggested.

410
Calvert, S. and L. Byers.
PARTICLE DEPOSITION FROM TURBULENT STREAMS BY THERMOPHORESIS. Jour. Air Poll. Control Assoc., v. 17: 595, Sept. 1967.

Research is being directed toward learning how the thermal force affects particle deposition from a turbulent stream. Both turbulent diffusion and thermophoresis may be important or limiting steps in particle transport. (Air Poll. Abs.)

411
Calvert, S. and R. Premerlani.
PARTICLE COLLECTION IN TUBE BANKS. Jour. Air. Poll. Control Assoc., v. 17: 594, Sept. 1967.

The objective of this research is to explore the properties of arrays of cylinders (tube banks) for particle collection and liquid drainage. Specific questions are on the effects of tube size and spacing, particle bounce, airflow, and liquid flow. The final result desired is an engineering design method for predicting collection efficiency, gas and liquid capacity, and pressure drop. (Air Poll. Abs.)

412
Halitsky, J.
IMPORTANT ASPECTS TO CONSIDER IN AIR POLLUTION CONTROL. Canadian Gas Journal (Don Mills, Ont.) v. 59: 5, Sept. 1966.

Contaminants normally released in combustion of natural gas in medium power residential heating and minor power generation applications are: solids - none; SO_2 - 3/10 ppm; NO_2-231 ppm; acids - 41 ppm; aldehydes - 51 ppm. Information on harmful effects of NO_2 and permissible concentrations for human beings is rather vague. One indication is the government code for residential areas in USSR which requires that no more than about 1/10 ppm be permitted on a 24 hour basis. The atmosphere is therefore required, to reduce the source concentration of NO_2 of 231 ppm to around 1/10 ppm in the vicinity of people. A high enough stack will achieve this but will not solve the problem of atmospheric pollution. (Air Poll. Abs.)

413
Hamming, W. J. and J. E. Dickinson.
CONTROL OF PHOTOCHEMICAL SMOG BY ALTERATION OF INITIAL REACTANT RATIOS. Jour. Air Poll. Control Assoc., v. 16: 317-323, 1966.

An attempt is made to show how several experimenters have quite closely equaled the results of the other, and how the results from these various laboratories can, by a change of coordinate system, be related to each other in a systematic manner. Only after demonstrating where the Los Angeles Civic Center atmosphere is in relation to these coordinates and the contours, or gradients, of these various effects, eye irritation and oxidant, is it possible to predict the photochemical effect of a reduction of olefins (hydrocarbons) or the reduction of nitric oxide. In addition, a study of the variation in eye irritation with irradiation time, demonstrates that the time at which eye irritation measurements are taken is important in understanding the entire photochemical mechanism underlying the "smog" problem in the summertime in Los Angeles. (Authors' Abs)

414
Hill, A. C.
A SPECIAL PURPOSE PLANT ENVIRONMENTAL CHAMBER FOR AIR POLLUTION STUDIES. Jour. Air Poll. Control Assoc., v. 17: 743-748, Nov. 1967. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967. (Paper No. 67-38)).

The controlled atmosphere aspects of the environmental chamber used for air pollution studies at the University of Utah are described. The chambers utilize an air tight, recirculating air system with controlled addition of CO_2. Wind velocity can be controlled up to 3 mi/hr. Temperature, which requires close regulation in a chamber of this design, is maintained by circulating water at the required temperature through heat exchangers located in the air stress. A three-way water mixing valve, proportional amplifier and temperature sensor in the air stress make up the water temperature control system. Low relative humidities are maintained with a similar water temperature control system utilizing a relative humidity sensor. This system circulates water through a second heat exchanger at the temperature required to condense moisture as rapidly as the plants emit it to the system. High relative humidities are maintained by precise addition of moisture to the system by automatic regulation of the vapor pressure of water in contact with heated air from the chamber. The air pollutant concentration is maintained by automatic or manual addition of the pollutant to the system. (Author's Abs.)

415
Hoffman, R. K., L. M. Buchanan and R. Spiner
β-PROPIOLACTONE VAPOR DECONTAMINATION [FOR VIRUSES, BACTERIA]. Appl. Microbiol., v. 14: 989-992, 1966.

Although β-propiolactone (BPL) is an effective vapor-phase decontaminant for enclosed areas, some problems have been encountered in its use. Adequate air circulation during BPL dissemination could eliminate most of these problems. It is recommended that, when decontaminating the ordinary building or laboratory, the amount of BPL sprayed be changed from the previously suggested 1 gal/16,000 ft^3 of space to 1 gal/25,000 ft^3. The use of aqueous BPL solutions and thermal-type generators is not recommended. (Authors' Abs.)

416
Stewart, W. S. and D. H. Wilken
A REPORT ON THE EFFECT OF SHADE TREES ON "SMOG." Lasca Leaves, v. 16, Autumn 1966.

Shade-trees and vines reduce smog in the area which they protect from the sun. Opaque objects also reduced smog as a result of the exclusion of direct sunlight. These results

suggest that shading by plants to reduce the smog level indirectly might be applied to parking lots, streets, and recreation areas. In these situations not only would the smog concentration be somewhat abated but the plantings would provide a more aesthetically pleasing environment.

417
Turk, A.
ODOR CONTROL. In: Kirk-Othmer Encyclopedia Chem. Technol., v. 14: 170-178, 1967.

A review of community air pollution problems and methods of odor control includes: ventilation or dispersal, adsorption, air oxidation, conversions, washing and scrubbing, irradiation, use of quarternary ammonium compounds, and counteracting and masking agents. (Chem. Abs.)

418
Washam, C. J., C. B. Black, W. E. Sandine, and others.
EVALUATION OF FILTERS FOR REMOVAL OF BACTERIOPHAGES FROM AIR. Appl. Microbiol., v. 14: 497-505, July 1966.

The effectiveness of glass wool, nonabsorbent cotton, fiberglas filter medium, and a commercial absolute filter in the removal of aerosolized bacterial viruses was tested under low flow rate (1 ft^3/min) and high flow rate (10 to 25 ft/min) air flow conditions. The design of special equipment is described. Under low air flow rate conditions, glass wool was only 98.543 to 99.83% efficient. Cotton (five layers), fiberglas medium (three layers) and commercial absolute filter were at least 99.900 and 99,999 efficient, respectively. In higher air flow condition glass wool and cotton were not used because they proved difficult to assemble in leak-tight filters. The commercial absolute filter and fiberglas medium (three layers) were at least 99.990 and 99.999 efficient, respectively, under higher air flow conditions. A stainless steel filter of simple design with three layers of fiberglas medium was also found highly efficient at a low flow rate. (APTIC Abs.)

419
Wasser, J. H., R. P. Hangebrauck and A. J. Schwartz
EFFECTS OF AIR-FUEL STOICHIOMETRY ON AIR POLLUTANT EMISSIONS FROM AN OIL-FIRED TEST FURNACE.
Jour. Air. Poll. Control Assoc., v. 18· 332-337, May 1968.

This paper describes an experimental, domestic-sized, oil-fired furnace to be used for evaluation of fuel additives and

equipment design modifications in reducing air pollutant emissions. Operating data and emissions of particulate matter, smoke, carbon monoxide, gaseous hydrocarbons, oxides of nitrogen, and oxides of sulfur are reported over the range of operable air-fuel ratio. Emission levels are interpreted in terms of key operating parameters and potential areas for reduction of emissions. (Authors' Abs.)

(c) Transportation

420
Caretto, L. S. and K. Nobe
PORE DIFFUSION EFFECTS IN THE CATALYTIC COMBUSTION OF ETHYLENE. Presented at: 152nd Meeting, Amer. Chem. Soc., New York, Sept. 11-16, 1966.

Elimination of air pollutants from exhausts of combustion processes by catalytic means have been given serious consideration for a number of years. In addition to the inherent chemical activity, the effectiveness of the catalyst may be strongly influenced by transport processes in the pores. This investigation reports on a study of the effects of pore diffusion in the catalytic combustion of ethylene on $CuO-Al_2O_3$ by varying the reactor configuration and maintaining a constant ratio of the tube and pellet diameter. Hydrocarbon analysis was determined with a flame ionization detector; infrared analyzers were used to determine concentrations of CO and CO_2. Other reaction products were analyzed with a gas chromatograph. Curvature of Arrhenius plots and increase in reaction order with temperature indicated a transition region between kinetic control at lower temperatures and pore diffusion control at higher temperatures. A calculation procedure developed to predict the conversion considering pore diffusion effects provided satisfactory agreement between calculated and experimental results. (Air Poll. Abs.)

421
Griswold, S. S.
REGULATION OF NEW MOTOR VEHICLES.
Presented at: Nat. Conf. Air Poll., Washington, D. C., Dec. 12-14, 1966.

The problem of air pollution from motor vehicles is discussed. The basis for the discussion is the Motor Vehicle Air Pollution Control Act. It is an amendment to the Clean Air Act of 1963 and was signed by President Johnson on October 20, 1965. It is designed to achieve uniform national control by limiting the emission from all new motor vehicles introduced into commerce, whether manufactured in the United States or imported from abroad. It authorizes the Secretary of Health, Education, and Welfare to establish standards for the emission of any substance which in his judgment is, or may be, injurious to public health or welfare and to require compliance with these standards. At the same time the Act specifies that appropriate consideration be given to technological feasibility and economic costs in prescribing standards applicable to new motor vehicles or engines. Federal emission standards were formally promulgated on March 30, 1966. These standards are applicable to the 1968 model year and reflect those currently in effect in the State of California. To implement these standards, to test for compliance and, generally, to provide the necessary machinery for insuring that the public gets the control it needs, the Abatement Branch of the Division of Air Pollution is establishing a fully equipped laboratory at the Willow Run Airport near Detroit. This laboratory also has the responsibility for evaluating the adequacy of existing standards and the need for more severe standards and less complex test procedures. Field surveys of equipped vehicles in California and elsewhere are also being conducted. Initial certification of new systems is approved on the basis of performance of test vehicles, but the continued approval for succeeding years will be determined by the systems' effectiveness when evaluated under realistic driving conditions. (APTIC Abs.)

422
Kittredge, G. D., R. C. Stahman and K. J. Springer.
SMOKE AND ODOR CONTROL [TECHNIQUES] DIESEL-POWERED TRUCKS AND BUSES. Presented at: SAE Midyear Meeting, Detroit, Mich., May 20-24, 1968, 34p. (Paper No. 680443)

Ten trucks and ten buses operated on a chassis dynamometer yielded maximum exhaust smoke and odor. Several control methods were applied, and the differences were determined by a panel of judges for rating odor concentration, a full-flow optical smokemeter for measuring smoke levels, and chemical analyses of the exhaust. Fumigation moderately reduced smoke, but only at low engine speeds. Injecting supplementary air near each exhaust valve reduced smoke but only in a four-cycle engine. Engine derating significantly reduced smoke emission in two out of three road tractors. The Jacobs Engine Brake, installed on a single bus, did not reduce smoke and odor. Tests on a five-truck fleet with a single commercial smoke-suppressing fuel additive resulted in lower smoke levels during 70,000 miles service. Installing two types of catalytic mufflers on buses resulted in a moderate reduction of odor level in some case, and one of the reactors also caused lower emission of oxygenated compounds and other gaseous pollutants. (Abs. Refining Lit.)

423
Ludwig, J. H.
PROGRESS IN CONTROL OF VEHICLE EMISSIONS. Jour. Sanitary Eng. Div., (Proc. Amer. Soc. Civil Engineers), v. 93: 73-79, Aug. 1967. (Paper No. 5380). (Presented at: Annual Meeting Transportation and Eng. Conf., Amer. Soc. Chem. Engineers, Philadelphia, Pa., Oct. 1966.)

The control of emissions from motor vehicles is reviewed from the standpoints of the contribution of vehicles to community air pollution, present progress in control regulations and application of devices, and the immediate and longer-term outlook for additional controls in the future. (Air Poll. Abs.)

424
McMichael, W. F., R. E. Kruse, and D. M. Hill.
PERFORMANCE OF EXHAUST CONTROL DEVICES ON 1966 MODEL PASSENGER CARS. Jour. Air Poll. Control Assoc., v. 18: 246-248, Apr. 1968. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967. (Paper No. 67-7)

Road tests have been carried out in five different cities with a fleet of 300 passenger cars consisting of three different makes, half of which are equipped with the 1966 exhaust control devices required by the state of California. The performance of these devices during the first series of tests has been evaluated. All three makes of device-equipped cars produced significantly lower emissions of hydrocarbons and carbon monoxide than did similar cars tested in 1962 and 1963. There were no consistent differences among the three makes of cars with respect to carbon monoxide and hydrocarbon emissions. (Authors' Abs.)

425
Miranda, J. M., V. J. Konopinski, and R. I. Larsen.
CARBON MONOXIDE CONTROL IN A HIGH HIGHWAY TUNNEL. Arch. Environ. Health, v. 15: 16-25, July 1967.

A 1.6-mile-long, 2-mile-high vehicular tunnel is planned for construction at Straight Creek, in the Rocky Mountains 60 miles west of Denver. Both elevation and carbon monoxide in the tunnel will tax the oxygen-carrying capacity of the blood of tunnel employees and individuals traveling through the tunnel. Based on present information, it is recommended that: 1. Carbon monoxide concentration in the tunnel be maintained below 25 ppm with one-hour averages no higher than 50 ppm and short term peaks no higher than 75 ppm. 2. Signs be placed on the route to the pass to warn sensitive individuals of the dangers of high elevations and smoking and to suggest possible alternate, lower routes. 3. Oxygen masks be provided at the tunnel for emergency use. 4. Construction workers who will be responsible for building the tunnel be carefully screened for cardiopulmonary abnormalities, as well as blood dyscrasias (sickle cell anemia). After screening the workers, a 7- to 14-day period of progressively increasing exercises will be necessary to obtain some degree of acclimatization. The men who cannot acclimatize efficiently will be the ones most likely to develop symptoms of hypoxia (eg, headache, vertigo, lethargy, easy fatigue, and sleepiness). 5. Full-time tunnel employees who will be working in the tunnel after its completion should be carefully screened and evaluated. Again acclimatization to some extent will probably be necessary considering that these men will be exposed to the additive effects of carbon monoxide and hypoxia. Because of the infrequency of major physical activity, their symptoms will probably be held to a minimum. (Authors' Abs., Modified)

426
Newhall, H. K.
CALCULATION OF ENGINE PERFORMANCE USING AMMONIA FUEL. II. DIESEL CYCLE. Univ. California, Dept. of Mechanical Engineering, Berkeley. Technical Report, Sept. 1965, 47p. (Report No. TS-65-3) (Contract No. DA-04-200-AMC-791(X)) AD 624565.

A digital-computer program was used to predict theoretical performance for NH_3 for diesel engines. The theoretical model employed was the diesel cycle, and products of combustion were treated as a chemical equilibrium system. Results are presented for NH_3 and in addition for cetene, a common hydrocarbon fuel. It was thus possible to directly compare the performance predicted for NH_3 with that predicted for commonly employed hydrocarbon fuels. The following conclusions regarding performance of NH_3 are based upon this work: (1) in the event of developments leading to successful combustion of NH_3 in diesel engine application,

NH_3 would yield up to 10% more power output than typical hydrocarbon fuels operating under the same conditions: (2) the thermal efficiency obtained with NH_3 would be greater than that for hydrocarbon fuels by as much as 20%; (3) specific fuel consumption for NH_3 may be expected to be approximately 2-1/2 times greater for NH_3 than for hydrocarbon fuels; (4) the exhaust concentration of nitric oxide resulting from the use of NH_3 should be substantially less than that produced by hydrocarbon fuels. (Chem. Abs.)

427
Newhall, H. K.
CALCULATION OF ENGINE PERFORMANCE USING AMMONIA FUEL. III. BRAYTON CYCLE. Univ. California, Thermal Systems Div., Berkeley. Technical Report, Dec. 1965, 80p. (Report No. TR-4, S-65-6) (Contract No. DA-04-200-AMC-791 (X)) AD 633633

The performance of NH_3 as a fuel for gas turbine application was theoretically predicted. Regenerative and non-regenerative Brayton cycles were employed as theoretical models, and combustion products were treated as a chemical equilibrium reactive system. All calculations were carried out by programs developed for use on an IBM 7094 digital computer. The following conclusions are based upon the theoretically predicted results: (1) NH_3 can yield power output $< 10\%$ greater than that for hydrocarbon fuels operating under the same conditions of limited turbine inlet temperature. (2) Thermal efficiencies for NH_3 should range $< 10\%$ higher than those for hydrocarbon fuels. (3) Specific fuel consumption for NH_3 is predicted to exceed by 2.5-3 times that for hydrocarbon fuels. (Chem. Abs.)

428
Newhall, H. K. and E. S. Starkman.
AMMONIA VERSUS HYDROCARBONS AS GAS TURBINE FUELS. SAE Jour., v. 75: 71-77, 1967.

The use of NH_3 as a gas turbine fuel is evaluated by comparison with cetene ($C_{16}H_{32}$) using the Brayton cycle for 3 cases: (1) ideal, nonregenerative, (2) nonideal, nonregenerative, and (3) nonideal, regenerative. The results are graphed and predict that NH_3 should yield (1) more power ($< 10\%$) delivered for the same fixed turbine inlet temperature, (2) higher thermal efficiency ($< 10\%$), and (3) poorer specific fuel consumption (2.5-3 times greater for NH_3). (Chem. Abs.)

429
Smith, D. S. and E. S. Starkman.
PERFORMANCE OF ANHYDROUS AMMONIA AS A SPARK IGNITION ENGINE FUEL. Univ. California, Thermal Systems Div., Berkeley. Technical Report, Feb. 1966, 63p. (Report No. TR-6, TS-66-2) (Contract No. DA-04-200-AMC-791(X)) AD 633632.

Ammonia can be used successfully as a spark ignition engine fuel and at presently existing compression ratios, if introduced as a vapor and if first partly dissociated to H and N. Under such circumstances little engine modification is necessary other than a means of flow control of the NH_3 and adjustment of the spark timing. Maximum experimental power output for NH_3 was 72% of that for isooctane. This result compares favorably with a theoretically predicted output, when adjusted for 5% H dissociation, of 75%. Specific fuel consumption using NH_3 is increased by a factor of 2 over that of hydrocarbon when compared at peak power and 2.5 times when compared at maximum economy. H concentration in the fuel feed is a critical factor for successful operation on NH_3 as fuel. Minimum concentration appear to be 4 to 5% by weight at intermediate engine speeds of 1800 rpm. Engine performance rapidly falls if less than minimum concentrations of H are used. This seems to relate to the self-generating character of the NH_3 decomposition during the compression and combustion process. Performance factors such as are influenced by engine speed, spark timing, and manifold pressure are not very different with NH_3 than with hydrocarbons as long as minimum amounts of H are inducted as a part of the fuel flow. (Chem. Abs.)

430
Squires, A. M.
CYCLIC USE OF CALCINED DOLOMITE TO DESULFURIZE FUELS UNDERGOING GASIFICATION. In: Fuel Gasification, Advanced Chem. Series No. 69. Ed. by R. F. Gould. Washington, D. C., Amer. Chem. Soc., 1967, p. 205-209. (Symposium sponsored by Div. Fuel Chem., at 152nd Meeting Amer. Chem. Soc., New York, Sept. 12-13, 1966)

Using [CaO + MgO] or [$CaCO_3$ + MgO] to desulfurize fluid fuels has been hampered by a lack of means to recover elemental sulfur from [CaS + MgO] while also recovering the original solid in a form suitable for reuse in a desulfurization step. The reaction of [CaS + MgO] with steam and CO_2 has been investigated at about 1000°F and 220 psia. Gaseous products contained H_2S

at a concentration suitable for a claus system. The solid product underwent no degradation in particle size and was suitable for reuse to absorb H_2S from fuel gases or vapors. (Authors' Abstract)

431
Starkman, E. S. and G. S. Samuelsen.
FLAME-PROPAGATION RATES IN AMMONIA-AIR COMBUSTION AT HIGH PRESSURE. In: 11th Symposium on Combustion, 1967, p. 1037-1045.

The reluctance of NH_3 to be ignited easily and the necessity to advance the spark for optimum performance in combustion engines led to this investigation. Ionization gap techniques showed that long induction times and slow flame speed were both contributors to the observed phenomena. Ammonia is characterized by a flame propagation rate $\sim 30\%$ slower, and an average kernal-development time 40% longer than for isooctane. The most important factor in determining combustion characteristics of NH_3 is the extent of predissociation prior to attempted ignition. At the start of compression, 3% to 5% by weight of H seems to be the lower limit for reliable ignition at representative compression ratios. Flame speed and engine speed correlate very well for isooctane, but only reasonably well for NH_3. An increase in compression ratio from 6:1 to 10:1 increased maximum flame speed of isooctane about 25% but that of NH_3 30%. A decrease in pressure reduced the flame speed of isooctane slightly. For NH_3, however, the flame speed appeared uneffected. There was evidence from combustion gas analysis that NO^+ was probably the most abundant ion contributing to successful application of the ionization gas techniques, and that NO^+ was probably produced in the pyrolysis of NH_3 rather than by equilibrium reactions. (Chem. Abs.)

432
Sweet, A. H., B. J. Steigerwald, and J. H. Ludwig.
THE NEED FOR A POLLUTION-FREE VEHICLE.
Jour. Air Poll. Control Assoc., v. 18: 111-113, Feb. 1968.

The immediacy of the need for pollution-free vehicles is investigated by projecting to 2010 vehicle emission densities for eight urban areas and measures of population exposure to pollution for four cities. Three degrees of emission control are applied. Application of 50% control to 1968 automobiles maintains emission densities below present levels for the next 20 years, but is less effective in reducing population exposure to pollution, in some cases only slowing the rate of growth. Application of 50% control in 1968 and 80% in 1973 fails to reduce emission densities below 50% of the present. Reduction. below 50% will eventually require an essentially pollution-free vehicle in many areas. (Authors' Abs.)

433
Altman, J. and S. Lawlor.
EFFECTS OF SOME CHLORINATED HYDROCARBONS ON CERTAIN SOIL BACTERIA. Jour. Appl. Bacteriol., v. 29: 260-265, 1966.

Some chlorinated organic pesticides, including a mixture of 1, 3-dichloropropene, 1, 2-dichloropropane, and related compounds, served as C or energy sources for cultures of common soil bacteria. A role of the breakdown products in increasing soil fertility was suggested. Organisms which utilized the pesticides included Rhizobium leguminosarum, Bacillus subtilis, Azotobacter vinelandii, Arthrobacter globiformis, Pseudomonas fluorescens, and 2 cornyebacteria. (Chem. Abs.)

434
Anderson, D. O.
CHRONIC NONTURBERCULOUS RESPIRATORY DISEASES. In: Preventive Medicine, Boston, Mass., Little, Brown and Co., 1967, p. 491-507.

The impact of communicable and organic nontuberculous respiratory diseases upon the North American community, problems in their definition and measurement, and general principles of prevention are discussed. (Author's Abs.)

435
Anderson, R. J.
MAN: HIS ENVIRONMENT AND HEALTH. Georgia Acad. Sci. Bull., v. 22: 1-7, 1964.

Environmental health is discussed in relation to the component factors air pollution, water pollution, radiological health and environmental engineering and food protection. (Biol. Abs.)

436
Apen, E. M., Jr., W. C. Cooper, R. J. M. Horton and others.
HEALTH ASPECTS OF CASTOR BEAN DUST. REVIEW AND BIBLIOGRAPHY. Cincinnati, Ohio, National Center for Air Pollution Control, 1967, 132p. (Public Health Service Publ. No. 999-AP-36)

Castor pomace, the residue that remains after castor oil has been removed from the beams of the castor plant, initially is in flat cakes, which are broken up into a fine, dry powder. This pomace contains one of the most potent allergens known. Severe allergic reactions can occur in exposed workers that do not have appropriate safeguards and also in persons in the neighboring community where the fine, light powder can be readily blown. This publication reviews the occupational and air pollution aspects of castor pomace. An annotated bibliography and selected translations of foreign articles are also included. (Public Health Eng. Abs.)

437
Blanchard, R. L. and J. W. Kearney.
NATURAL RADIOACTIVITY AND CESIUM-137 IN ALASKAN CARIBOU AND REINDEER SAMPLES. Environ. Sci. & Technol., v. 1: 932-939, 1967.

The concentrations of Po^{210}, Pb^{210}, Ra^{226}, and Cs^{137} were determined in bone, muscle, and rumen content of caribou and reindeer from Alaska. The Po^{210} and Cs^{137} concentration in the muscle varied with the season, reaching a maximum in spring and a minimum in the fall. A similar variation in the Po^{210} and Cs^{137} concentrations was observed in the rumen content. The relations of Po^{210} and Cs^{137} between muscle and rumen content are examined. The Po^{210} to Pb^{210} ratio in muscle also varied during the year, reaching a maximum in the spring. The Pb^{210} content of the bone did not appear to vary with the season. However, an increase occurred with increasing latitude and age. Except for animals one year or less in age, the Po^{210} to Pb^{210} activity ratio was near unity. The specific activities of Ra^{226} in bone and muscle were small in comparison with the concentrations of Pb^{210}, Po^{210}, and Cs^{137}. (Chem. Abs.)

438
Cooper, W. C., and I. R. Tabershaw.
BIOLOGIC EFFECTS OF NITROGEN DIOXIDE IN RELATION TO AIR QUALITY STANDARDS. Arch. Environ. Health, v. 12: 522-530, 1966.

Data on the biologic effects of nitrogen dioxide on man and lower animals [mammals] over a wide range of concentrations were studied. Present evidence suggests that long-continued exposures should not exceed the range 0.5-1 ppm. This is based on the evidence of increased mortality in lower animals exposed to aerosolized microorganisms after NO_2 exposures and the pathological effects demonstrable in animals continuously exposed to levels in the range of 4-5 ppm. Brief exposures should not exceed 3 ppm over a period of 1 hr. The recommendations relate to the possible effects of NO_2 on health alone and do not consider potentiation or additive effects nor any contributions to plant damage and visibility. (Authors' Abs.)

439
Corn, M.
AEROSOL RESEARCH AT THE UNIVERSITY OF PITTSBURGH. Jour. Air Poll. Control Assoc., v. 17: 606-607, Sept. 1967.

Research is outlined concerning shape, optical properties, and chemical characteristics of airborne particles, the formation of aerosols, and the biological effects on human subjects and cats exposed to irritant gases. (Biol. Abs.)

440
Deichmann, W. B.
SAFE HANDLING AND USE OF ORGANIC PHOSPHATE PESTICIDES. Indus. Med. and Surg., v. 36: 267-271,

In the coverage of the title subject, topics include: (1) precautionary measures for the home owner, agricultural sprayer, and pest control operator; (2) responsibilities of management; and (3) medical supervision of workers handling organic phosphate pesticides. The treatment of organic phosphate intoxication is outlined. (Chem. Abs.)

441
Doerner, A. A.
AIR POLLUTION AND CHRONIC LUNG DISEASE. Ann. Allergy, v. 23: 475-485, 1965.

In 1959, the Los Angeles County Air Pollution Control District estimated that in Los Angeles County each day 1,000 tons of unburned hydrocarbons were poured into the air from automobiles, buses and trucks, and an additional 650 tons were dumped into the atmosphere by local industry, public utility plants and private residences. Hydrocarbons are toxic only at high concentration but when subjected to the influence of solar radiation in the presence of oxides of nitrogen, photochemical reactions ensue and formation of ozone and ozonoids take place. Ozone, in turn, oxidizes hydrocarbons and thus produces acids, alcohols, aldehydes and ketones. Carbon monoxide, from incomplete combustion of motor fuel provides additional atmospheric contamination. (Biol. Abs.)

442
THE EFFECTS OF AIR POLLUTION.
Washington, D. C., Public Health Service, National Center for Air Pollution Control, 1967, 18p.

Air pollution's contribution to disease and premature death is discussed as are the types of pollutants. Other detrimental effects of air pollution include abscurring visibility, attacking of materials, and injuring and/or killing plants.

443
Ehrlich, R.
AEROBIOLOGY [CONFERENCE]. Science, v. 154: 293-296, 1966.

The following reports were given at the 2nd International Conference on Aerobiology in March, 1966: radioisotope studies on respiratory tract defenses against inhaled bacterial aerosols; in vivo and in vitro techniques for observing ciliary activity and mucous flow in the upper respiratory tract; the effect of the route of inoculation on experimental viral disease in humans through analysis of coughs and sneezes; the importance of the Coxsackie virus inoculum in determining the localization and severity of infection; antibiotic prophylaxis and therapy of airborne tularemia; toxic effects of O_2 on aerosolized and lyophylized bacteria; effect of shifts in humidity on airborne bacteria; airborne transmission of Venezuelan equine encephalomyelitis; exposure of monkeys to aerosols containing Bacillus anthracis; epidemiology of airborne staphylococcal infection; aerosol vaccination with tetanus toxoid; and effects of nitrogen dioxide and ozone on respiratory infection resistance. (Biol. Abs.)

444
Happ, J. W., J. B. Harstad, and L. M. Buchanan.
EFFECT OF AIR IONS ON SUBMICRON T1 BACTERIOPHAGE AEROSOLS. Appl. Microbiol., v. 14: 888-891, 1966.

The effect of a high concentration of ionized air molecules on sampling T1 phage aerosols of submicron particle size was evaluated by comparing the phage recoveries of all-glass impingers (AGI-4) and type 6 filter papers. Sampler recoveries of all ionized aerosols were less than the recoveries of nonionized control aerosols. These reductions in recovery were greater with positive ions than with negative ions or ions of mixed polarity. The AGI-4 allowed considerable slippage, which was not affected by the air ions. Type 6 filter paper recoveries were less than AGI-4 recoveries. The air ions did not appear to affect the aerosol particle size as determined by an electron microscope. (Author's Abs.)

445
Heimann, H.
STATUS OF AIR POLLUTION HEALTH RESEARCH, 1966. Arch. Environ. Health, v. 14: 488-503, Mar. 1967. (Presented in part at: Amer. Indus. Hyg. Conf., Pittsburgh, Pa., May 16-20, 1966)

Consideration is limited to man-made air pollutants, omitting naturally occurring adventitious airborne materials. Radioactive materials were not discussed. Acute episodes of air pollution; systemic effects of air pollution caused by arsenical compounds, mercury, beryllium, lead, carbon monoxide, economic poisons, manganese, and asbestos; air pollutants as irritants; medical conditions such as acute nonspecific upper respiratory disease, chronic obstructive ventilatory diseases, chronic bronchitis, pulmonary emphysema, bronchial asthma, and lung cancer, are reviewed. (APTIC Abs.)

446
Heldman, D. R., T. I. Hedrick, and C. W. Hall.
FACTORS INFLUENCING THE TRANSPORT OF AIR-BORNE BACTERIA AT OPENINGS. Jour. Food Sci., v. 32: 352-356, 1967.

Contamination of products during packaging can be reduced by reducing the population of airborne microorganisms in the packaging area. In many cases, significant contributions to airborne populations may come from adjoining rooms through doors and other openings. Experimental results were obtained by generating a bacterial aerosol into one side of a 2 compartment chamber. Transport of the aerosol through an opening between the compartments was expressed in terms of a transfer coefficient. The massflux of aerosol was determined by measurement of aerosol concentration at the low concentration compartment outlet under steady-state condition. The transfer coefficient (k_c) increased significantly as the flow rate through both compartments increased from 20 to 40 ft^3/min. Results obtained with air flow rate gradients ranging from -30 to + 30 ft^3/min with respect to an aerosol flow rate of 40 ft^3/min indicate that the transfer coefficient is maximum at equal air flow rates and the decreases for either positive or negative gradients. Transfer coefficients decreased as the opening height was increased from 3 to 9 in. The decrease was nearly 40% at equal air flow rates. A change in temperature gradient from -14° to + 12.5°F with respect to a reference to 75°F caused a significant increase in the transfer coefficient. Changes in aerosol viability due to changes in temperature and relative humidity did not account for the entire influence of temperature on the transfer coefficient. (Authors' Abs.)

447
Helsper, J. T., G. S. Sharp, and D. E. Rounds.
THE SYNERGISTIC EFFECT OF LASER RADIATION AND IONIZING RADIATION ON MALIGNANT TUMORS IN VIVO AND IN VITRO. Amer. Jour. Roentgenol., Radium Therapy and Nuclear Med., v. 99: 446-449, 1967.

The nature of this preliminary study did not permit quantitation of the combined X-ray and laser therapy in vivo. The response of the lesions was consistent with the observed symergism in the vitro study report of McGuff. The data confirm previous reports that laser energy alone has some tumoricidal effect. Even a 100 joule focused ruby laser beam will not destroy muscle or kidney tissue beyond a depth of a few mm. Scattering within the tissue prevents the accumulation of the required photon density for cellular disruption. A portion of the photons from a 20 joule unfocused ruby laser beam could be detected at a tissue depth of 5 cm, which can be considered important in the potentiation of X-rays at these depths. A neodymium pulsed laser (10,600 A) or a modified He-Ne continuous wave laser (11,500 Å) may have more value than the ruby laser for this purpose. (Authors' Abs.)

448
Hewson, E. W.
AIR POLLUTION BY RAGWEED POLLEN. I. RAGWEED POLLEN AS AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 17: 651-652, Oct. 1967.

Bronchial asthma and hay fever are typical human physiological responses to exposure to aeroallergens. Acute allergic dermatitis sometimes also occurs. The respiratory allergies are discussed and the roles of the agricultural and construction industries in the spread of ragweed pollinosis are described. Some possible avenues for the control of ragweed are included. (APTIC Abs.)

449
Jaffe, L. S.
THE BIOLOGICAL EFFECTS OF OZONE ON MAN AND ANIMALS. Amer. Indus. Hyg. Assoc. Jour. v. 28: 267-277, May-June 1967.

Recent literature on the effects of ozone exposures on man and animals is reviewed, with emphasis on the effects of low concentrations of ozone (0. 05 to 0. 20 ppm). Irradiation of the mucous membranes of the upper respiratory tract, a decrease in visual acuity and other changes in ocular parameters, an enhancement in mortality of respiratory infected test animals, the sphering of red blood cells, structural changes in the nuclei of myocardial tissue, and an increase in mortality of newborn animals have been reported within this range. At higher concentrations (0. 6 to 0. 8 ppm for 2 hours), ozone will interfere with lung function for the duration of exposure and beyond. Other effects of ozone include distinct respiratory distress, coughing, choking and severe fatigue, which occur at concentrations at or below 1. 0 ppm (the maximum level of ozone ever measured in dense atmospheric photochemical air pollution). (Author's Abs.)

450
Jaffe, L. S.
THE BIOLOGICAL EFFECTS OF PHOTOCHEMICAL AIR POLLUTANTS ON MAN AND ANIMALS. Amer. Jour. Public Health, v. 57: 1269-1277, 1967.

A review of the important adverse biological effects of atmospheric photochemical smog on man and animals expressed in terms of atmospheric "total oxidant" concentrations is presented, based on published reports and some unpublished reports and research findings. Data based on laboratory exposures of man and animals to the pure agents, ozone and peroxyacyl nitrates (PAN compounds), important components of the "total oxidant" mixture which have been identified in photochemical smog, are reviewed. (Author's Abs.)

451
Jaffe, L. S.
PHOTOCHEMICAL AIR POLLUTANTS AND THEIR EFFECTS ON MEN AND ANIMALS. Arch. Environ. Health, 16: 241-256, Feb. 1968.

When concentrations of photochemical oxidants are used as measures of photochemical smog intensity, a number of specific biological effects on man and animals based on both atmospheric and laboratory studies have been documented. Photochemical oxidants, such as routinely found in urban communities as measured by continuous air monitoring instruments used by federal, state, and local agencies, cause a repeated and continuing biological impact on man and animals in every region of the country. The degree and types of the documented biological effects are dependent on the local community atmospheric level attained and the frequency of occurrence.

452
Kantor, S. Z. and L. Wasserman.
STUDIES ON THE ANTIGENICITY OF MOLDS AND HOUSE DUST. Israel Journal of Medical Sciences (Jerusalem), v. 2: 534-540, 1966. (Presented in part at: 1st Convention of Allergol. and Appl. Immunol., Tel Aviv, Israel, Oct. 25-27, 1964).

A study was carried out on the antigenicity of the molds Alternaria, Stemphylium and Hormodendrum and of house dust. The antigenic extracts were fractionated by means of electrophoresis on agar gel. The antigenicity and some chemical properties of the various fractions were investigated by Ouchterlony gel diffusion, tanned cell hemagglucination, electrophoresis and immunoelectrophoresis. Each of the molds contained glycoprotein in addition to proteins. The glycoprotein was antigenic in Alternaria only. Cross-reactivity studies demonstrated antigenic relationship between Alternaria and Stemphylium. Cross-reactivity of Hormodendrum with the other antigens was slight and inconstant. House dust proved to be a specific antigen, which failed to cross-react with the molds investigated. (APTIC Abs.)

453
Krueger, A. P., S. Kotaka, K. Nishizawa, and others.
AIR ION EFFECTS ON THE GROWTH OF THE SILKWORM (BOMBYX MORI L). Internat. Jour. Biometeorol., v. 10: 29-38, 1966. AD 646704.

The exposure of silkworm eggs (BOMBYX MORI L) to unipolar ionized atmpspheres of either charge at 24°C and 26°C induced an earlier onset of hatching. Continued treatment of the larvae produced the following physiological effects: (1) A marked increase in the rate of larval growth; (2) Increased biosynthesis of catalase, peroxidase and cytochrome c oxidase; (3) Earlier onset of spinning; (4) A significant increase in weight of cocoon at 24° and 26°C. At 24°C treatment with either (+) or (-) ions caused a statistically valid increase in pupal weight but at 26°C this occurred only after (+) ion treatment. Exposure at both 24°C and 26°C to air ions of either charge resulted in development of heavier silk layers but the increases were not statistically significant. (Authors' Abs.)

454

Laurenzi, G. A.

BRONCHIECTASIS. In: Current Therapy 1967. Ed. by H. F. Conn. Philadelphia, Pa., W. B. Saunders Co., 1967, p. 81-83.

Bronchiectasis is dilatation and distortion of the bronchial tree, involving medium-sized and small bronchi, and bronchioles. Most often, this condition has its origin in a suppurative bronchopnuemonia which results in destruction of bronchial walls. The injury results in denudation of the bronchial mucosa, destruction of bronchial musculature and elastic coats, and peribronchial suppuration. The most vulnerable areas are 81 points of branching. The treatment of bronchiectasis is directed at the mobilization of secretions, the relief of bronchospasm, and the prevention and treatment of infection. Basic to all bronchial therapy is the institution and maintenance of the best possible ventilation to the affected parts. For this purpose, all patients should be started on an intensive course of aerosolized fluid and bronchodilators in order to keep the inflamed mucosa moist, reverse local bronchoconstriction. and stimulate mucus flow. It is important to remember that productive cough must not be interfered with; however, irritating cough which often aggravates bronchospasm should be controlled. Bronchopulmonary infection is a constant threat to the bronchiectatic patient. Whenever it is possible, treatment with antibiotics should be instituted and guided by the results of sputum cultures and sensitivity tests. Unfortunately, in bronchiectasis, these studies may be confusing because of the mixed flora they often yield. Nevertheless, one should search for P. pneumoniae, H. influenza, and S. aureus. These bacteria are most often associated with an acute illness. In treatment the best results are obtained with drugs which are effective against the pheumococcus. For control of a chronic infection, tetracycline adequately prevents the colonization of pneumococcus and hemophilus and is often given during the seasons of greatest distress or more constantly in patients with a greater incidence of infection. The dosage schedules for chronic illness are 0.75 to 1.0 g a day or 1.0 g every other day for months. (APTIC Abs.)

455
Mead, J.
REGULATION OF BREATHING. In: Physiology in the Space Environment, v. 2, Respiration. Washington, D. C., National Academy of Sciences, National Research Council, 1967, p. 57-58. (Publ. No. 1485B)

The slight alterations in pulmonary mechanics to be expected under zero G and possible deviations in inspired O_2 and CO_2, depending on the composition of the cabin atmosphere, could affect the level of ventilation through well-known mechanisms. Current knowledge indicates that these effects would be too small to be physiologically significant. Minute volume tends to decrease during acceleration even to the point of apnea, but as long as its duration is brief no more serious stress than that of ordinary breath holding would exist. Hyperventilation can occur under stress, but it is not a problem unique to space flight. (Author's Abs.)

456
Mead, J.
RESPIRATORY MECHANICS. In: Physiology in the Space Environment, v. 2, Respiration. Washington, D.C., National Academy of Sciences, National Research Council, 1967, p. 26-30. (Publ. No. 1485B)

Sufficient acceleration will limit or prevent lung movements during launch, but such periods will probably not exceed the limits of breath holding. The mechanical strength of the lung may place a limit on the accelerative forces to which the human body can safely be subjected. Probably the pulmonary blood vessels would rupture before the parenchyma tore. During zero G, changes in lung mechanics would be minimal. A decrease of about 20% in end-expiratory lung volume and a resulting small decrease in airway conductance would be expected. Inspiration of particulate matter might be more common, in which case the cough mechanism is more important. On theoretical grounds, the air velocity with a cough would probably be greater, but the decreased density of the gas might make the cough less effective. (Author's Abs.)

457
Mead, J., J. M. Turner, T. Macklem, and others
SIGNIFICANCE OF THE RELATIONSHIP BETWEEN LUNG RECOIL AND MAXIMUM EXPIRATORY FLOW. Jour. Appl. Physiol., v. 22: 95-108, 1967.

During forced expirations lateral pressures at points within airways equal pleural pressure, and the pressure drop from alveoli to these points approximates the static recoil pressure of the lungs. Maximum expiratory flow is regarded as set by this pressure and the flow-resistance of the airways upstream from these points. The resistance of these segments has a frictional component which increases as lung volume decreases and an accelerative component which decreases as lung volume decreases. The two components show systematic changes with age in normal subjects which are interpreted as reflecting differential loss of parenchymal and airway recoil. (Authors' Abs.)

458
Morgan, W. K. C.
CHRONIC BRONCHITIS: THE "ENGLISH DISEASE." Postgrad. Med., v. 41: 190-194, 1967.

The English do not have a monopoly on chronic bronchitis. It is becoming an increasing problem throughout the Western world. There is evidence that bacterial infection plays some role in development or prolongation of exacerbations and that viral infection precedes the exacerbation in a large proportion of cases. Prompt treatment of exacerbations seems to be as effective as long-term use of an antibiotic; a 7 to 10 day course of antibiotic therapy is recommended. (Author's Abs.)

459
Porter, C. A.
HEXANES. Kirk-Othmer Encyclopedia Chem. Technol., v. 11: 1-5, 1966.

A review of the manufacture, hazards, and uses of hexanes is presented. (Chem. Abs.)

460
Proctor, D. F.
AIRBORNE DISEASE AND THE UPPER RESPIRATORY TRACT. Bacteriol. Rev., v. 30: 498-513, Sept. 1966.

The author studied the roles of the upper respiratory passages and respiratory mucosa in defense against airborne disease and what factors influence their function. Techniques to study the respiratory air stream, and, through the external detection of radioisotopes, the deposition of airborne particles and their motion in the respiratory mucociliary stream are reported. (Public Health Eng. Abs.)

461
Rich, S. and H. Tomlinson.
EFFECTS OF OZONE ON CONIDIOPHORES AND CONIDIA OF ALTERNARIA SOLANI. Phytopathology, v. 58: 444-446, Apr. 1968.

Ozone at 0.1 ppm for 4 hr or at 1.0 ppm for 2 hr stopped elongation of conidiophores of Alternaria solani, caused their apical cells to swell, and often collapsed the cell wall at their tips. These conidiophores began to elongate again when they were removed from ozone and exposed to light to prevent sporulation. Usually the collapsed end wall was sloughed, and the new cells often grew at an angle to the original axis of the conidiophore. Sometimes breaks appeared in the pigmented layers of the walls of the swollen cells. Ozone-damaged conidiophores given the necessary dark period, sporulated normally. If sporulating cultures were exposed to 1.0 ppm ozone for 30 min the conidia began to germinate while still attached to the conidiophores. Conidiophores treated with a subtoxic dose of sulfhydryl-binding reagent (α-iodoacetamine) became more susceptible to ozone. Exposure to pure oxygen at either 1 or 4 atmosphere pressure for 4 hr caused no visible damage to conidiophores of A. solani. (Authors' Abs.)

462
Small, M., N. Mantel, and S. S. Epstein.
THE ROLE OF CELL-UPTAKE OF POLYCYCLIC COMPOUNDS IN PHOTODYNAMIC INJURY OF TETRAHYMENA PYRIFORMIS. Exper. Cell Res., v. 5: 206-217, 1967.

The cell-uptake and photodynamic activity of 25 polycyclic compounds, with varying number of fused rings and with varying carcinogenicity, were measured in the ciliate T. pyriformis. The cell-uptake of these compounds varies inversely with their molecular size. High cell concentrations of polycyclics are prerequisite but not sufficient for high photodynamic activity. Futher more, high photodynamic activity is not determined by cell concentration of polycyclics alone, even when adjustment is made for difference in light absorption of the compounds or when consideration is restricted to those compounds capable for forming strong charge-transfer complexes. (Authors' Abs.)

463
Starkman, E. S.
VARIOUS COMPONENT GASES OF ENGINE-GENERATED POLLUTION POSE DIFFERING HEALTH HAZARDS. SAE Jour., v. 75: 85-87, 1967

Exhaust gas from automobile engines consists of unburned hydrocarbons, N oxides, CO, carcinogens, particulate matter, Pb, odor, and S oxides. The hazards and control of each of these constituents is briefly discussed. (Chem. Abs.)

464
Stokinger, H. E. and D. L. Coffin.
BIOLOGIC EFFECTS OF AIR POLLUTANTS. In: Air Pollution, v. I. Air Pollution and Its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 445-546.

Experimental work, chiefly in animals on the biologic aspects of air pollutants is discussed. Where possible the mechanism of action of individual air pollutants or special combinations are given. The number of substances whose effects have been studied in animals expressly because of their air pollution interest is small. Air pollution-oriented toxicologic research; particularly on the inorganic substances, has been confined to eliciting new details or unusual aspects of the biologic action of a few pollutants such as ozone, nitrogen dioxide, and sulfur dioxide, and of their behavior in concentrations lower than those of 8-hr/day, 5-day week occupational exposure. (Authors' Abs., Modified)

465
Whittenberger, J. L.
THE PHYSICAL AND CHEMICAL ENVIRONMENT. In: Preventive Medicine, Boston, Mass., Little, Brown and Co., 1967, p. 623-642.

Environmental health problems are discussed with particular emphasis on atmospheric pollution and ionizing radiation. The effects of pesticides and water pollution are discussed briefly. (Biol. Abs.)

466
Williams, T. F.
VIEWPOINT. The D.O., v. 8: 70-75, Apr. 1968.

The results of an interview with T. F. Williams are presented. Air pollution as a health problem and what can be done to alleviate the hazard are the main topics.

(a) Biochemistry and Biophysiology

467

Abiko, Y., T. Suzuki, and M. Shimizu.
INVESTIGATION ON PANTOTHENIC ACID AND ITS RELATED COMPOUNDS. VI. BIOCHEMICAL STUDIES. 2. DETERMINATION OF COENZYME A BY THE PHOSPHOTRANSACETYLASE OF ESCHERICHIA COLI B. The Journal of Biochemistry (Tokyo), v. 61: 10-17, 1967.

A modified phosphotransacetylase method for the determination of CoA using phosphotransacetylase from Escherichia coli B is described. This method has a high specificity for CoA. Diluted solutions of phosphotransacetylase from this source are inactivated during storage, but the enzyme is stable in the presence of sulfate ion. The inhibitory effects of sulfate ion and other inorganic salts on the enzyme activity are also reported. (Authors' Abs.)

468

Bachmayer, H., L. H. Piette, K. T. Yasunobu and others.
THE BINDING SITES OF IRON IN RUBREDOXIN FROM MICROCOCCUS AEROGENES [DIALYSIS]. Proc. Nat. Acad. Sci., U. S., v. 57: 122-127, 1967.

The following factors are considered in the article: electron paramagnetic resonance (EPR) spectrum and its variation with pH, the sequence studies on the location of cysteine residues and the quantitative analysis of the number of -SH groups. The results have suggested that the 1 ferric (Fe) in rubredoxin is coordinately bonded in a rhombic symmetry to 4 -SH groups (provided by 4 cysteine residues) and possible to tyrosine or lysine residues. The cystein residues are located in positions, 6, 9, 38 and 41 in the rubredoxin molecule. The Fe may function not only as an electron acceptor but to stabilize the conformation of the molecule. (Authors' Abs.)

469

Bauer, R. D., W. Loring, and N. B. Kurnick.
STUDIES OF DNA OF IRRADIATION-DAMAGED NUCLEOPROTEIN. Radiation Res., v. 26: 507-518, 1967.

A dissociation of deoxyribonucleoprotein to DNA and protein takes place in increasing concentrations of NaCl solution. Rat thymus DNA, which dissolved in-various salt solution, was chromatographed on ECTEOLA-cellulose. The chromatography results showed that the DNA solubilized by 0.8 M NaCl was more readily eluted than that solubilized by 1.5 M NaCl, which suggests that the 0.8 M soluble material is of lower molecular weight. Therefore, the smaller DNA molecules apparently dissociate from the protein more readily at low sale concentrations than do the larger DNA species. The DNA isolated from tissues of rats subjected to lethal total-body X-irradiation was compared with that isolated from control animals. In the case of the thymus and spleen, differences in the chromatographic profiles and sedimentation coefficients of the DNA indicated degradation had taken place after irradiation could be detected by either of these physiocochemical techniques. No changes in the solubility in salt solutions of the nucleoprotein complex of the kidney were noticed postirradiation. It appears from the fractionation and irradiation studies that degradation of the DNA postirradiation may be at least part of the cause of changes in stability of the important DNA-protein complex. Since the DNA of the radioresistant kidney showed no change, whereas that of the radiosensitive thymus and spleen showed changes closely correlated with irradiation, DNA itself may be quite radioresistant, and X-ray damage to the nucleic acid is more likely the result of indirect effects. (Authors' Abs.)

470

Benarde, M. A., W. D. Snow, P. Olivieri, and others.
KINETICS AND MECHANISM OF BACTERIAL DISINFECTION BY CHLORINE DIOXIDE. Appl. Microbiol., v. 15: 257-265, 1967.

Survival data are presented for a fecal strain of Escherichia coli exposed to three concentrations of chlorine dioxide at four temperatures. Chick's first-order reaction equation is generalized to a pseudo nth-order model. Nonlinear least squares curve-fitting of the survival data to the nth order model was performed as an analogue computer. The data were observed to follow fractional order kinetics with respect to survival concentration, with an apparent activation energy of 12,000 cal-mole. Initial experiments support the thesis that the mechanism of chlorine dioxide kill occurs via disruption of protein synthesis. (Authors' Abs.)

471

Boucher, R. M. G., M. A. Pisano, G. Tortora, and others.
SONOCHEMICAL STERILIZATION. Ultrasonics, v. 5: 168-172, 1967.

The synergistic effects observed during the sterilization of Bacillus subtils var niger ATCC 9372 by the combined action of ethylene or propylene oxide with high intensity airborne sound waves (34.8 kHz) were investigated. The number of surviving spores deposited on paper strips decreased exponentially with the sound intensity at sample level. Reductions of the order of one third of the time required for standard propylene oxide sterilization was observed by using the combined action of sound waves and gaseous sterilization. Maximum synergistic effects were achieved at a propylene oxide concentration of 500-1000 mg/l, acoustic intensity of 161-162 decibels, contact time 80 min, temperature 60°, and relative humidity of 40%. (Chem. Abs.)

472
Caneghem, P. van and F. Stein.
EFFECT OF THE INJECTION OF CYSTAMINE AND OF VARIOUS SHOCK STATES ON THE PLASMA PROTEINS OF RATS, RABBITS, AND CHICKENS. **Archives Internationales de Physiologie et de** Biochimie (Liège), v. 75: 769-785, 1967.

An injection of cystamine (I)-dihydrochloride (150 mg/kg) into rats, rabbits, and chicks induced a state of shock. It was manifested by hypoproteinemia, a decrease in plasma sialic acid, a decrease in protein-bound disulfide and sulfhydryl content, an increase in free disulfide and sulfhydryl content, and hemoconcentrations. In rats, similar changes were found in states of shock induced by other means. A more pronounced shock was produced by intravenous injection of I. The amount of protein-bound disulfide and sulfhydryl followed that of plasma albumin. There was no correlation between the level of α-globulins and sialic acid. The level of plasma sialic acid seems to be a good indicator of the intensity of the shock. In contrast to other states of shock, there was no reversal of the albumin-to-globulin ratio in the plasma after I injection. The particular state of shock induced by I must be considered in the protective effect of this amine against ionizing radiation. (Chem. Abs.)

473
Dahlgren, S. and T. Dalhamn
THE EFFECT OF OXALAMINE CITRATE ON EXPERIMENTALLY PRODUCED INFLAMMATION IN THE RESPIRATORY. Acta Pharmacologica et Toxicologica (Köbenhavn) v. 24: 286-296, 1966.

The effect of oxolamine citrate on experimentally produced respiratory tract inflammation is reported. The inflammatory reactions were produced by exposing the experimental animals to an acrolein aerosol. The studies were performed on 2 identical series of 20 animals. Oxolamine citrate has a statistically significant anti-inflammatory effect. (Authors' Abs.)

474
Epstein, S. S., J. Forsyth, I. B. Saporoschetz and others.
AN EXPLORATORY INVESTIGATION ON THE INHIBITION OF SELECTED PHOTOSENSITIZERS BY AGENTS OF VARYING ANTITOXIDANT ACTIVITY. Radiation Res., v. 28: 322-335, 1966.

The interactions between 25 selected antioxidants and 4 photosensitizing agents have been investigated over a wide concentration range at log-fold increments, using a previously established *in vivo* bioassay for antioxidants based on their ability to protect *Tetrahymena pyriformis* against the oxygen-dependent effects of photodynamic toxicity. These data have been topologically characterized by families of contours of constant response (isobols), the importance of whose general pattern, rather than whose individual locations and slopes, is stressed. Protective effects, in general, increase progressively with increasing antioxidant concentrations and with decreasing photosensitizer concentrations; they are similar for a given antioxidant, irrespective of which photosensitizer it is tested against. Antioxidant and photosensitizer dose-response slopes are a function of the width of horizontal and vertical separations, respectively, between adjacent isobols. No characteristic isobol pattern is seen for primary or secondary antioxidants, or for antioxidants within a particular group, such as the "hindered" phenols or amines. (Authors' Abs.)

475
Estes, F. L.
BIOCHEMICAL EFFECTS OF SIMULATED AIR POLLUTANTS.
Baylor Univ., College of Medicine, Houston, Tex.,
Progress Report No. 2 (Jan. 1, 1963 - June 30, 1967), 1967, 102p.

In an air pollution mixture formed by the irradiation of air containing NO_2 and butene-1, the amount of the reactants consumed and the inhibition of the growth of *E. coli* were functions of the initial ratio of the reactants. The decrease in activity of glutamic dehydrogenase was linear with time of exposure of the enzyme to the photochemical reaction products. Further work indicated that aldehydes *per se* were probably not the inhibitor(s) for this enzyme, and led to methods for the direct determination of reactants and products for lactic and for glutamic dehydrogenase. With the validation of these parameters, a method for the determination of some of the Krebs Cycle components was developed. The observations of the formation and effects of the photochemical reaction products indicated the need for parallel kinetic examination of products formed and their effectiveness in specific biochemical systems. Valid examination of the rates of product formation has been implemented by the construction of modular apparatus which provides more precise control of the concentration of reactants and their delivery to the irradiation chamber. (Author's Abs.)

476
Fishbein, L., L. Zielinski, Jr., R. O. Thomas and others.
PHOTODECOMPOSITION OF PIPERONAL. Nature, v. 212: 180-182, 1966.

The identification of protocatechualdehyde and protocatechuic acid as 2 of the degradation products of the irradiation of piperonal is important in the light of recent work which postulates that oxidative metabolism of methylene-dioxybenzenes can explain inhibition of the metabolism of carbamates and other pesticides by this class of synergistic agents. Catechol derivatives, as possible products of this process, were also thought to be able to compete with the pesticide at some limiting stage of metabolism. (Biol. Abs.)

477
Goldstein, B. D., and O. J. Balchum.
EFFECT OF OZONE ON LIPID PEROXIDATION IN THE RED BLOOD CELL. Proc. Soc. Exper. Biol. and Med., v. 126: 352-358, 1967.

Washed human erythrocytes suspended in phosphate-buffered saline solution at pH 7.4 were treated with ozone (40 ppm in room air). This resulted in an increased osmotic fragility associated with formation of compounds reactive to 2-thiobarbituric acid. This suggests that lipid peroxidation may be involved in the mechanism of ozone toxicity. (Chem. Abs.)

478
Gosselin, R. E.
PHYSIOLOGIC REGULATORS OF [RESPIRATORY] CILIARY MOTION [IN MAMMALS, FROG]. Amer. Rev. Respiratory Diseases, v. 93: 41-59, 1966. (Symposium on Structure, Function, and Measurement of Respiratory Cilia, Durham, N.C., Feb. 18-19, 1965)

Attention was directed toward various mechanisms by which an organism may regulate the activity of its cilia. Examples were cited in which celia appear to be under nervous control; both inhibitory and excitatory innervation were described. Except in the frog palate, however, vertebrate cilia are not known to be innervated. The hypothesis that the autorhythmicity of cilia is controlled by local pacemaker substances was worthy of attention. Various physiologic amines were considered as potential pacemaker substances in ciliated epithelia, notably acetylcholine, epinephrine, norepinephrine, serotonin (5-HT), tyramine, tryptamine, and histamine. Among the amines examined serotonin, probably functioned as a ciliary pacemaker substance in mollusks but not elsewhere. Electrolytes also have profound effects on cilia, and some drugs may be cilioactive because they modify cellular ionic fluxes or concentrations. Aside from H^+, the cation that has attracted the most attention is K; but Ca also appears to play a key role, at least in protozoan cilia. The intensity of ciliary activity is determined ultimately by the metabolic apparatus that provides the necessary energy. Apparently O_2 is always required for sustained ciliary motion, even in tissues which can survive complete anaerobiasis because of vigorous glycolysis. Tissue O_2 consumption and carbohydrate catabolism tend to change in parallel with drug-induced alterations in ciliary activity. Essentially nothing is known about the physiologic regulation of mammalian cilia. Attempts to study the complex actions of serotonin on lamellibranch gill cilia serve to emphasize that ciliary beat frequency and the velocity of particle transport are not the only important parameters. More physiologic and pharmacologic studies of ciliary motion are needed. (Author's Abs.)

479
Green, G. M., and E. H. Kass.
MECHANISMS OF RESISTANCE TO BACTERIAL INFECTION IN THE LUNG. In: Inhaled Particles and Vapours II, Proc. Internat. Symposium, Cambridge, England, Sept. 28-Oct. 1, 1965. Ed. by C. N. Davies. New York, Pergamon Press, 1967, p. 229-237.

The quantitative measurement of bacterial clearance is a useful method for evaluating the physiologic state of mechanisms of resistance to bacterial infection in the lung. Immunofluorescence and radiotracer studies showed that the bactericidal action of alveolar macrophages accounts for most of this clearance activity. Studies of the effects of several agents on the clearance of different bacterial species showed that at any time, the effectiveness of clearance depends on; (1) the antibacterial activity of host cells, (2) the species of infecting bacteria, and (3) the specific action on the lung of exogenous agents. It is postulated that many genetic, environmental, and endogenous factors which lower host resistance exert their pathogenic action by a direct action on the function of alveolar macrophages. (APTIC Abs.)

480
Gunn, S. A., T. C. Could, and W. A. D. Anderson.
PROTECTIVE EFFECT OF THIOL COMPOUNDS AGAINST CADMINUM-INDUCED VASCULAR DAMAGE TO TESTIS.
Proc. Soc. Exper. Biol. and Med., v. 122: 1036-1039, 1966.

Vascular damage to mouse testis is caused by subcutaneously administered $CdCl_2$(0. 012 m-mole/kg) was prevented by cysteine (6 m-mole/kg) when the thiol was administered 30 min before, 30 min after or 3 hr following Ca. Glutathione (6 m-mole/kg) was less consistent, and methionine (12 m-mole/kg) and sodium thiosulfate (6 m-mole/kg) offered no protection whatsoever. Testicular damage was completely blocked by BAL (0. 5 m-mole/kg) when administration of the dithiol preceded that of Cd by 6 hr. The results of this paper, demonstrating that the testis could be protected from Cd by thiols, reopens the possibility that Cd may exert damage to testicular vasculature by interference with essential sulfhydryl groups. (Authors' Abs.)

481
Hackney, J. D., F. Bils, M. J. Evans, and others.
FUNCTIONAL AND MORPHOLOGICAL RESPONSE OF IN VITRO LUNG AND MYOCARDIAL TEST OBJECTS TO EXPERIMENTAL GAS ENVIRONMENTS. Jour. Air Poll. Control Assoc., v. 18: 9-11, Jan. 1968. (Presented at: 60th Annual Meeting Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967)

Innovations in the use of lung and myocardial tissue in vitro have permitted continuous morphological observation of cells treated with a controlled gaseous environment. The mammalian tissues are covered with a dialysis membrane and cultured in a Rose chamber containing a large gas phase. Test gases can be flushed continuously through two hypodermic needles in the culture chamber wall. Rabbit lung tissue was cultured in the Rose chamber and exposed to $NaNO_2$ concentrations which were adjusted to be equivalent to NO_2 gas. The use of $NaNO_2$ was decided upon to facilitate the introduction of NO_2 to the cells. Cell types could be recognized for 5 days or more in electron microscopic preparations. After 1 day of exposure to 40 ppm NO_2, swelling and blebbing of the surface of the epithelial cells was seen; none was found in the control. More extensive involvement was apparent after 1 day exposure to 100 ppm and after 3 days of exposure to 40 ppm NO_2. The beating rate of myocardial cells was found to be an objective and convenient endpoint for testing the characteristics of the exposure system. A comparison of the response of cells in the gas phase with that of elements in the fluid phase within the same chamber suggested that this system can serve as a model for evaluating the effect of an increasing diffusion barrier. (APTIC Abs.)

482
Hosein, E. A., S. J. Booth, I. Gasio and others.
NEUROMUSCULAR BLOCKING ACTIVITY AND OTHER PHARMACOLOGIC PROPERTIES OF VARIOUS CARNITINE DERIVATIVES. Jour. Pharmacol. and Exper. Ther., v. 156: 565-572, 1967.

Although carnitine has long been known to be present in the body, little is known of its physiologic function. Acetylcarnitine also is present in the body and has important biochemical properties but its cholinomimetic properties are not clear. Carnitine has 2 sites for ester formation and a variety of mono- and diester derivatives of it have been prepared and tested for: neuromuscular blocking activity on the isolated rat phrenic nerve-diaphragm and frog sciatic nerve-gastrocnemius muscle preparations; acetylcholine-like activity on cat blood pressure, guinea-pig ileum and physostigmine-treated frog rectus muscle; and hydrolysis by the cholinesterases. It was found that while certain carboxyl group derivatives of carnitine and acetylcarnitine, e.g., nitrile, ethyl chloride and choline, were potent neuromuscular blockers, they were less active than d-tubocurarine, decamethonium and succinylcholine. Acetyl-di-carnitylcholine has one-eighth the acetylcholine-like activity of acetylcholine and the ratio of its nicotinic to its muscarinic activity is unity. True cholinesterase rather than pseudocholinesterase partly destroys acetyl-dl-carnitylcholine. This destruction is completely inhibited by physostigmine. (Authors' Abs.)

483
Mudd, J. B.
REACTION OF PEROXYACETYL NITRATE WITH GLUTATHIONE. Jour. Biol. Chem., v. 241: 4077-4080, 1966.

Peroxyacetyl nitrate reacts with the sulfhydryl groups of reduced glutathione. Thioester formation accounts for as much as 50% of the reacted sulfhydryl groups. As much as 60% of the reacted sulfhydryl groups can be accounted for as oxidized glutathione. The stoichiometry of the reaction is approximately 3 moles of sulfhydryl reacting per mole of peroxyacetyl nitrate and this stoichiometry is the same over the pH range 4.0-8.6 in acetate, phosphate and Tris buffers. Amino acid analyses of reduced and oxidized glutathione after treatment with peroxyacetyl nitrate show that cysteic acid is produced, but not in sufficient quantity to account for the decrease in cystine. (Author's Abs.)

484
Mudd, J. B., R. Leavitt, and W. H. Kersey.
REACTION OF PEROXYACETYL NITRATE WITH SULFHYDRYL GROUPS OF PROTEINS. Jour. Biol. Chem., v. 241: 4081-4085, 1966.

Peroxyacetyl nitrate does not react with the sulfhydryl groups of "native" ovalbumin, but does react with those of reduced glutathione in the presence of ovalbumin. At pH 4.5 all of the sulfhydryl groups of human hemoglobin react with peroxyacetyl nitrate, whereas at pH 7.2 the reaction is slower and limited to 2 to 3 sulfhydryls per mole of hemoglobin. Ribonuclease in the reactive form is not inactivated by peroxyacetyl nitrate even when the oxidant is in 300 fold molar excess. Amino acid analysis of the protein shows a decrease in cystine and increase in cystein acid. Reduced ribonuclease is prevented from regaining activity if exposed to peroxyacetyl nitrate in the sulfhydryl form. The inactivation of papain by peroxyacetyl nitrate depends on the amount of free protein sulfhydryl at the time of gas exposure. (Authors' Abs.)

485
Murphy, S. D.
LIVER METABOLISM AND TOXICITY OF THIOPHOSPHATE INSECTICIDES IN MAMMALIAN, AVIAN, AND PISCINE SPECIES. Proc. Soc. Exper. Biol. and Med., v. 123: 392-398, 1966.

The quantities of active cholinesterase inhibitors which accumulated when malathion, parathion, or Guthion was incubated with liver slices from 2 mammalian (mice and rats), 2 avian (chickens and sparrows), and 4 piscine (sunfish, bullheads, winter flounder, and sculpin) species were compared. The capacities of liver homogenates from these 3 classes of animals to inactivate the O analogs of these compounds (i. e., malaoxon, paraoxon, and gutoxon) were also compared. The relative capacities of liver slices from the various species to produce and accumulate cholinesterase inhibitors varied, depending upon the insecticide studied. Fish livers had considerably less capacity than mammalian and avian livers to inactivate malaoxon and paraoxon, but the destruction of the anticholinesterase activity of gutoxon by liver homogenates did not differ appreciably among the 3 classes. The greater susceptibility of sunfish than mice to poisoning by malathion or malaoxon correlated well with liver metabolism studies in that far more anticholinesterase activity was inactivated by mouse liver homogenates than by sunfish liver homogenates. Toxicity-metabolism correlations were less obvious for Guthion and gutoxon, and the lesser susceptibility of sunfish than mice to poisoning by parathion and paraoxon was opposite to what would be expected from the liver metabolism data. (Chem. Abs.)

486
Murphy, S. D.
MALATHION INHIBITION OF ESTERASES AS A DETERMINANT OF MALATHION TOXICITY. Jour. Pharmacol. and Exper. Ther., v. 156: 352-365, 1967.

The hydrolysis of malathion by rat, mouse and guinea pig liver homogenates and by rat plasma was inhibited after treatment of the animals with malathion. In rates and guinea pigs the hydrolysis of malathion was inhibited by doses of the insecticide below those which inhibited brain or erythrocyte cholinesterase. After single large doses of malathion, inhibition of malathion-esterase occurred sooner and persisted longer than cholinesterase inhibition. Evidence that inhibition of malathion-esterase occurs in vivo and is important in determining the toxicity of subsequent doses of malathion was obtained in experiments which showed that guinea pigs and rats that were pretreated with less than cholinesterase-inhibiting quantities of malathion were more sensitive to poisoning by subsequent doses of the insecticide. The results of several in vivo and in vitro experiments suggested that a metabolite of malathion (possibly the oxygen analog, malaoxon) was the actual inhibitor of malathion-esterase and that technical grade samples of malathion may contain a small quantity of this inhibitor. The results of this investigation indicate that an early biochemical event leading to poisoning by malathion is the inhibition of its own further hydrolytic detoxication by a metabolite (or, in cases of less pure samples, by a contaminant) of the parent insecticide. (Author's Abs.)

487
Murphy. S. D.
RESPONSE OF ADAPTIVE RATE LIVER ENZYMES TO ACUTE POISONING BY ORGANOPHOSPHATE INSECTICIDES. Toxicol. Appl. Pharmacol., v. 8: 266-276, 1966.

After acute poisoning of rats by organophosphate insecticides there is an increase in the activities of hepatic alkaline phosphatase and tyrosine-α-ketoglutarate transaminase. These effects are mediated by the adrenals and resemble those produced by injection of glucocorticoids and exposure to toxic irritants. Maximum effects on liver enzymes occur several hours after the maximum cholinesterase depression produced by a single dose of a short-acting organophosphate such as Dipterex. Delnav has a more prolonged anticholinesterase action and also produced a greater and more prolonged elevation of hepatic alkaline phosphatase and tyrosine transaminase activities. The physiological significance of the effect of organophosphates on adaptive liver enzymes is not apparent from this study. However, the findings support the hypothesis that poisoning by chemicals in the environment may produce metabolic alterations that are mediated through the pituitary-adrenal system, and occur in tissues remote from the primary sites of toxic action. It seems possible that these subtle metabolic effects may contribute to the occurrence of signs and symptoms that are not readily explained by the better known mechanisms of action of these substances. (Author's Abs.)

488
Murphy, S. D. and S. Porter.
EFFECTS OF TOXIC CHEMICALS ON SOME ADAPTIVE LIVER ENZYMES, LIVER GLYCOGEN, AND BLOOD GLUCOSE IN FASTED RATS. Biochem. Pharmacol., v. 15: 1665-1676, 1966.

After poisoning by an irritant (acrolein) and several organophosphate insecticides, the liver glycogen content of fasted rats was increased. This effect and the effects of these chemicals on blood glucose and some adaptive rat liver enzymes were compared in adrenalectomized, hypophysectomized, and adrenal demedullated rats, and in rats treated with inhibitors of protein synthesis. The results suggested that acrolein increased glycogen deposition by stimulating the secretion of increased amounts of adrenal glucocorticoids, which in turn stimulate the synthesis of adaptive liver enzymes that are required for gluconeogenesis and glycogenesis. Increased liver glycogen deposition after administration of the organophosphate, Guthion, appeared to be dependent upon adrenal hormones but was apparently independent of stimulation of adaptive enzyme synthesis. Increased availability of carbohydrate precursors resulting from increased muscle glycogenolysis appears to contributed to the hyperglycemia and liver glycogen depositions following Guthion poisoning. (Chem. Abs.)

489
Myrvik, Q. N. and D. G. Evans.
METABOLIC AND IMMUNOLOGIC ACTIVITIES OF ALVEOLAR MACROPHAGES. Arch. Environ. Health, v. 14: 92-96, 1967.

In rabbits alveolar macrophages containing phagocytized Mycobacterium bovis strain BCG killed by autoclaving, the ratio of CO_2 produced from glucose-1-^{14}C to that produced from glucose-6-^{14}C increased with incubation time, showing that the gluconic shunt pathway of glucose oxidation is stimulated by phagocytosis of BCG. In rabbits given 5 mg of BCG in 5 ml of saline intratracheally, lysozyme and acid phosphatase levels of the alveolar macrophages reached maximum concentrations 5-7 days after inoculation. Extracts of macrophages of rabbits which had received an intratracheal injection of 10^9 living cells of M. smegmatis showed marked antibacterial activity after 4 days. Inoculation of 0.5-ml aliquots of the extract with 10^3 colony-forming units of M. smegmatis resulted in complete elimination of the organism after a 48-hr incubation. The antibacterial substance is distinct from lysozyme. Exposure of macrophages in vitro to air containing 50 ppm NO_2 caused reduction in phagocytosis and oxidation of glucose by the gluconic acid shunt pathway. (Chem. Abs.)

490
Nadel, J. A.
MECHANISMS OF AIRWAY RESPONSE TO INHALED SUBSTANCES. Arch. Environ. Health, v. 16: 171-174, Feb. 1968.

A study, using cats and dogs, of the effect of certain drugs (atropine sulphate, histamine) on the ability of the bronchi to inhibit passage of inhaled particles (dust) is discussed. (Air Poll. Abs.)

491
Pace, D. M., B. T. Aftonomos, A. Elloitt and others.
OBSERVATIONS ON SOME EFFECTS OF THE SODIUM SALTS OF CERTAIN MONOCARBOXYLIC ACIDS ON ESTABLISHED CELL LINES. Canadian Journal of Biochemistry (Ottawa), v. 45: 81-88, 1967.

There appears to be very little information in the literature pertaining to concentrations of various air pollutants or tobacco-smoke constituents that may be toxic or nontoxic to tissue cells cultivated in-vitro. We have undertaken the task of ascertaining these levels and this report records observations concerning the first few of many known pollutants. The effects of the sodium salts of 10 monocarboxylic acids (formate, acetate, propionate, butyrate, valerate, caproate, oenanthylate, caprylate, caprate, and benzoate) on several established cell lines (HeLa, strain L, human lung, human skin) were studied. All of these compounds at a concentration of 10 mg % were toxic to the cell lines tested with the exceptions of formate, acetate, and benzoate on strain L, and of valerate and caprylate on human lung. All the compounds either stimulated proliferation or had no significant effect at 1 mg % except caproate and benzoate, which were toxic to human lung and human skin cells, respectively. (Authors' Abs.)

492
Permutt, S.
PULMONARY CIRCULATION AND THE DISTRIBUTION OF BLOOD AND GAS IN THE LUNGS. In: Physiology in the Space Environment, v. 2: Respiration. Washington, D. C., National Academy of Science, National Research Council, 1967, p. 38-56. (Publ. No. 1485 B)

The relations between blood flow and ventilation are likely to be optimal in the weightless state. Acceleration may produce adverse effects, however, and it is important to be able to evaluate risks and the physiological tolerances involved. Basic knowledge is needed concerning the effect of acceleration on the blood volume and capacitance of the systemic circulation, and of changes of volume in the vascular structures of the thorax presumably caused by reflex and hormonal mechanisms. The effects of gravity are so profound in altering the distribution of blood and gas within the lung that many problems in basic pulmonary physiology can be studied more effectively under weightlessness than in a normal gravitational field. One of the dividends of space flight will be the opportunity to carry out experiments on the lungs that are impossible on Earth. (Author's Abs.)

493
Schlicting, H. E., Jr., B. Bryant and R. Phelps.
THE EFFECTS OF SELECTED COORDINATION COMPOUNDS UPON THE RATE OF RESPIRATION OF ESCHERICHIA COLI. Texas Jour. Sci., v. 19: 154-163, 1967.

Twenty-eight coordination compounds of Co(III), 4 of Cr(III), and 4 of Rh(III) were synthesized and tested manometrically at 1, 0.1, and 0.01% for their effect on the respiration of *E. coli*. Ten compounds, i.e., $[Co(en)_2(C_2O_4)]Cl$, $[Co(en)_2(L\text{-lysine})_2]Cl_2$, and others, increased the respiration rate, while 17 compounds, i.e., 1-cis$[Co(trien)Cl_2]Cl$, $[Co(en)_2(L\text{-aspartic acid})]Cl_2$, and others, decreased the respiration rate. (Chem. Abs.)

494
Smith, R. P.
THE OXYGEN AND SULFIDE BINDING CHARACTERISTICS OF HEMOGLOBINS GENERATED FROM METHEMOGLOBIN BY TWO ERYTHROCYTIC SYSTEMS. Molec. Pharmacol., v. 3: 378-385, 1967.

Methemoglobinemia induced in mice and other animals protects against death from inhaled hydrogen sulfide or injected sodium sulfide. Equivalent circulating levels of methemoglobin impart equivalent degrees of protection irrespective of the agent used to induce the methemoglobinemia (nitrite, p-aminopropiophenone, or hydroxylamine). In each case 2-4 moles of sulfide are apparently inactivated in vivo for each available ferric heme group. The ferric iron of methemoglobin is one site available for hydrosulfide anion binding. No information is available about the nature of the additional sulfide binding sites, but they are inferred to be associated with the globin moiety. Protection against sulfide poisoning is not demonstrable in mice after methemoglobin levels have been reduced to normal concentrations by spontaneous methemoglobin reductase activity. However, if methemoglobin reductase activity is increased by methylene blue, a ferrous hemoglobin which retains significant sulfide-inactivating properties exists transiently in vivo. This protective effect is also lost after a interval equivalent to that required for spontaneous activity to reduce methemoglobin levels to normal in the absence of methylene blue. In mouse erythrocytes exposed to sodium nitrite the non-methemoglobin heme produced as a result of methylene blue-induced reductase activity has only one-tenth of the oxygen capacity of normal mouse hemoglobin or the product of normal mouse methemoglobin reductase activity. A fully functional mouse hemoglobin in terms of its oxygen capacity is eventually generated in the presence of both methylene blue and nitrite if enough time is allowed for the spontaneous reductase to act. Similarly, the total ferrous hemoglobin products of methylene blue-induced reductase activity in nitrited human cells have less than half the oxygen-binding capacity of normal human hemoglobin. These findings suggest that spontaneous reductase activity restores a fully functional hemoglobin whereas methylene blue-induced reductase activity only reduces the heme iron. The methylene blue therapy of methemoglobinemia bears reexamination in terms of these findings. (Author's Abs.)

495
Smith, R. P., and R. A. Abbanat.
PROTECTIVE EFFECT OF OXIDIZED GLUTATHIONE IN ACUTE SULFIDE POISONING. Toxicol. Appl. Pharmacol., v. 9: 209-217, 1966.

Pretreatment of mice with oxidized glutathione (GSSG) protects them against a subsequent lethal challenge with sodium sulfide. This protective effect is additive to that imparted by methemoglobin as previously reported. The conclusion is reached that the protective actions of oxidized glutathione and of methemoglobin are similar, namely, a trapping of free sulfide thereby preventing it from reaching vital enzymatic sites. Evidence is presented to show that the mechanism of this reaction is based on a scission of the disulfide bridge of glutathione by the hydrosulfide anion. Oxygen, however, is required for the ultimate irreversible detoxication of sulfide. In contrast to the slow disulfide-bond cleavage by cyanide, the reaction of sulifde with some disulfide bridges is rapid enough to be of biological importance. Attempts to alter blood GSH [reduced glutathione]: GSSG ratios in mice without producing methemoglobin were unsuccessful; however, the possibility remains that the reaction of sulfide with oxidized glutathione or other endogenous disulfide bridges constitutes an important natural detoxication process. (Authors' Abs.)

496
Terr, A. I., R. J. Allen, and N. A. Vanselow.
IMMUNOLOGIC RESPONSIVENESS IN PHENYLKETONURIA. Jour. Amer. Med. Assoc., v. 198: 1185-1188, 1966.

Since patients with phenylketonuria (PKU) may have elevated serum phenylalanine levels, immunologic responsiveness was studied in phenylketonuric children on normal diets and on low-phenylalanine diets. The immune response of subjects with PKU did not differ significantly from that of normal controls as measured by antibody response following immunization with diphtheria toxoid and Vi antigen, development of positive tuberculin skin tests following immunization with BCG, and frequency of clinically apparent infections. Children with PKU who were on a low-phenylalanine diet had significantly lower serum levels of IgG and IgM than did normal controls. The latter finding was probably an effect of the diet itself and not of the phenylketonuria per se. (Chem. Abs.)

497

Thomas, H. V., P. K. Mueller and R. L. Lyman.
LIPOPEROXIDATION OF LUNG LIPIDS IN RATS EXPOSED TO NITROGEN DIOXIDE. Science, v. 159: 532-534, 1968.

Absorption spectra characteristic of diene conjugation and typical for peroxidized polyenoic fatty acids can be induced in rat lung lipids after the rats have been exposed to a scant amount of NO_2 (1 ppm) for 4 hrs. The peroxidative changes do not occur immediately but appear to reach a maximum at 24-48 hrs after exposure. The prooxidant effect of this atmospheric pollutant in rat lung lipids may be partially prevented by prior treatment of the animal with large doses of α-tocopherol. (Chem. Abs.)

(b) Biomedical Techniques

498

Ballenger, J. J., H. B. Harding, F. W. Dawson, and others.
MEASUREMENT OF CILIARY ACTION. CULTURAL METHODS FOR MEASURING CILIARY ACTIVITY. Amer. Rev. Respiratory Diseases, v. 93: 61-66, 1966. (Symposium on Structure, Function, and Measurement of Respiratory Cilia, Durham, N. C., Feb. 18-19, 1965).

The respiratory ciliary activity was measured by methods of tissue culture. The significance of results depends upon the method and accuracy of measurements. The actual growth in culture of ciliated epithelial cells was accomplished many times. This fact is only indirectly related to this session, at least as far as the mammalian explant is concerned. If the vitamin-A content is not carefully controlled nonciliated dedifferentiated cells are produced. The growth can be recorded by time-lapse photography. This is only a qualitative measure. A method of "organ culture" in which human ciliated epithelium is grown for weeks without de-differentiating will be described. (Authors' Abs.)

499

Battigelli, M. C., T. F. Hatch, F. Hengstenberg, and others.
TRITIATED THYMIDINE LABELING IN THE STUDY OF ACUTE INJURY FROM AIR POLLUTANTS. Arch. Environ. Health, v. 12: 747-750, 1966.

The need to quantify pulmonary injury in small laboratory animals exposed to irritant aerosols has suggested the use of DNA synthesis rate as indicator of cellular homeostasis. Labeling DNA synthesis by an autoradiographic technique employing tritiated thymidine the effects of inhaled mixture of diluted diesel exhaust, of nitrogen dioxide, and of phosgene, in separate experiments, were followed over a period of a few days from the inhalation. The preliminary results indicate that the DNA synthesis rate offers the advantage of a simple numerical index, well suited to quantifying injury. However the sensitivity of this method appears limited to the effects accompanied by histological abnormalities. The first evidence of change appears within 1 or 2 days from the exposure and it tends to disappear a week or so after the exposure. (Authors' Abs.)

500
Berkley, C., J. Churg, I. J. Selikoff and others.
THE DETECTION AND LOCALIZATION OF MINERAL FIBERS IN TISSUE. Ann. New York Acad. Sci., v. 132: 48-63, 1965. (Presented at: Symposium Biological Effects of Asbestos, New York, Oct. 19-21, 1964).

Two methods, electronic ashing and fluorescence tagging, were developed for localizing the fibers in sections before they become grossly apparent by developing into asbestos bodies. These techniques were designed for use in experimental studies in animals to locate individual fibers in situ shortly after respiratory exposure and in the study of human biopsy or autopsy specimens, especially in the absence of asbestos bodies. (Authors' Abs.)

501
Bouhuys, A.
AIRFLOW CONTROL BY AUDITORY FEEDBACK: RESPIRATORY MECHANICS AND WIND INSTRUMENTS. Science, v. 154: 797-804, 1966.

The auditory signal provided by a soprano recorder in a breathing circuit can help human subjects to regulate inspiratory expiratory airflow rates at constant preset levels. This method of airflow control is useful in studies of the static and dynamic mechanical properties of the lungs and may have additional applications in human respiration physiology. (Author's Abs.)

502
Corn, M., and M. Y. Flynn.
DISPERSION OF AEROSOLS IN HOSPITALS UTILIZING AEROSOL INHALATION THERAPY. Amer. Indus. Hyg. Assoc. Jour., v. 28: 386-387, 1967.

Uranine dye was used to trace the dispersion of aerosol produced by a DeVilbiss ultrasonic generator used for inhalation therapy of a bedridden hospital patient. Air for ventilation of the hospital room was supplied through ceiling level grilles; air was exhausted through outlets in the hospital corridor. Particles of uranine, formed after evaporation of aerosol droplets, were detected in the hospital corridors by sampling with Millipore HA filter paper and analyzing the sample fluorimetrically for uranine. Infectious agents, as well as dye, could be dispersed throughout the hospital. Inhalation therapy should be administered in hospital rooms where ventilation air is supplied from the corridor and exhausted from the therapy room. (Authors' Abs.)

503

Hinners, R. G., J. K. Burkart, and G. L. Contner.
ANIMAL EXPOSURE CHAMBERS IN AIR POLLUTION STUDIES. Arch. Environ. Health, v. 13: 609-615, Nov. 1966.

As part of the Division of Air Pollution's overall program for studying the biological effects of atmospheric pollutants on animals and man, a study of chronic exposure to auto exhaust, oxides of sulfur, and oxides of nitrogen was initiated. To elucidate the affected biologic parameters previously described from this laboratory, extensive facility modifications were undertaken. This paper presents the changes made in the animal exposure facilities of the Laboratory of Medical and Biological Sciences, including addition of new animal exposure chambers, and brings up to date the design for the present study. (Air Poll. Abs.)

504

Holma, B.
LUNG CLEARANCE OF MONO- AND DI-DISPERSE AEROSOLS DETERMINED BY PROFILE SCANNING AND WHOLE-BODY COUNTING (A STUDY OF NORMAL AND SO_2 EXPOSED RABBITS). Acta Medica Scandinavica Supplementum (Stockholm) No. 473, 1967, 102p.

A profile scanning method was used to study lung clearance in rabbits. The validity of the method was evaluated by studies on rabbit phantoms with known distributions of activity, as well as on living animals exposed to radioactive aerosols and thereafter sacrificed, the radioactivity in the isolated lung being measured by a conventional scaler technique. These comparisons demonstrated that profile scanning is well suited to the investigation of lung clearance during the first hours after exposure and up to one or two weeks thereafter. The profile scanning method seems to be superior to methods previously used with stationary detector systems. This superiority is due in part to the fact that this measuring technique is less dependent on changes in the position of the activities within the volume being studied than are other external measuring studies, the condensation and spinning disc methods were used, The effect of SO_2 (10 ppm- 16 hr a day during ca 10 wk) on lung clearance of a di-disperse aerosol (6 and 3 micron particles) was evaluated by comparing the exposed with the control group. No effect was seen on the first phase during 5 weeks of SO_2 exposure. An accelerating effect was, however observed during the first 6 weeks of the slower phase of the 3 micron particles but not the 6 micron particles. Prolonged exposure - more than 6 weeks - diminished this effect on the slower phase. (APTIC Abs.)

505

Hubbard, D. M., F. M. Creech, and J. Cholak.
DETERMINATION OF COBALT IN AIR AND BIOLOGICAL MATERIAL. Arch. Environ. Health, v. 13: 190-194, 1966.

A procedure combining various ideas obtained from the literature was developed for the determination of Co in a variety of biologic materials, such as urine, blood, and tissue. The method involves the removal of Fe by treating the solutions of the ashed sample with cupferron, followed by complexing the Co with sodium diethyldithiocarbamate and extracting the metal complex into chloroform. Cobalt in the chloroform extract is then determined colorimetrically by forming the Co-Nitroso-R-Salt complex. It was found that the levels of concentration of Co in the urine and blood were extremely low, varying from 1 μg to 7 μg/l of urine, and less than 0.25 μg/100 gm of blood. (Authors' Abs.)

506

Jensen, C. R., S. D. Van Gundy, and L. H. Stolzy.
DIFFUSION-EXCHANGE RESPIROMETER USING THE CARBON DIOXIDE ELECTRODE. Nature, v. 211: 608-610, Aug. 1966.

Respirometers may be classed as either open or closed systems. A new type of open system respirometer has been developed using a Severanghaus type of potentiometric CO_2 electrode and diffusion exchanger. The new respirometer measures CO_2 evolution and has the simplicity of open system types. The construction of the respirometer and its accuracy are discussed.

507

Jonson, B., and A. Bouhuys.
MEASUREMENT OF ALVEOLAR PRESSURE [MAN]. Jour. Appl. Physiol., v. 22: 1081-1085, 1967.

Alveolar pressures can be measured over a wide range of airflow rates and lung volumes, using a volume-displacement body plethysmograph with a rebreathing bag to minimize thermal exchange between lung and plethysmograph air (modified Jaeger-Otis method). Suitable plethysmographic volume change (Δ Vbox) recording can be obtained by conditioning both the air in the plethysmograph (at near room temperature) and the gas in the rebreathing bag (at BTPS [Body temperature and pressure saturated with water vapor] conditions). Procedures and limitations of this method are discussed. (Authors' Abs.)

508
Keenan, R. G.
CHEMICAL ASPECTS OF ENVIRONMENTAL HEALTH. Occupational Health Review (Ottawa), v. 18: 3-8, 1966.

Modern methods of physical and chemical analysis, as applied to biological materials, atmospheric samples containing gaseous or particulate contaminants, industrial process materials, intermediates, and finished products are discussed briefly. A discussion of the uses to be made of such analytical data includes: (1) the "normal" concentrations of certain metallic elements in body tissues and fluids; (2) the need to compare these concentrations with those developed analytically on samples from exposed subjects; (3) the comparison of atmospheric concentrations of contaminating substances found in the working environment with the A. C. G. I. H. Threshold Limit Values; and (4) the analysis of industrial process materials, settled dusts, and finished products to help in assessing the total exposure of the worker to chemical elements. (APCA Abs.)

509
Kistler, G. S., P. B. Caldwell, and E. R. Weibel.
ELECTRON MICROSCOPIC AND MORPHOMETRIC STUDY OF RAT LUNGS EXPOSED TO 97% OXYGEN AT 258 TORR (27,000 FEET). Universität Zurich. Anatomisches Institut (Switzerland). Progress Report Feb. 1964-July 1965. Dec. 1966, 21p. (Report No. AMRL TR 66-103) AD 649542.

A group of young growing rats was exposed to 97% oxygen at 258 torr in a controlled environmental chamber. They were sacrificed in groups after 1, 5, and 14 days and their lungs were processed for morphometric examination in light and electron microscope according to standardized procedures. No qualitative pathologic changes in lung structure were found even after two weeks of oxygen exposure. Only one exception was an apparent increase in the number of eosinophilic granulocytes within the lung capillaries of test rats which had been exposed to pure oxygen for 5 and 14 days. In the test animals a fall in lung volume and in lung-volume-to-bodyweight ratio was concurrent with impairment of body growth. Morphometric analysis revealed a statistically highly significant decrease in alveolar surface area, capillary surface area, and volume in dependence of the duration of oxygen exposure. These changes are interpreted as "oxygen effect" which, however cannot be called "oxygen toxicity" proper. Rather they are regarded as adaptation of the (growing) organism to increased oxygen tension in the breathing medium. (Authors' Abs.)

510
Konno, K., and J. Mead.
MEASUREMENT OF THE SEPARATE VOLUME CHANGES OF RIB CAGE AND ABDOMEN DURING BREATHING. Jour. Appl. Physiol., v. 22: 407-422, 1967.

Changes in the anteroposterior diameters of the rib cage and abdomen were recorded on the axes of a direct-writing X-Y recorder both during relaxation against a closed airway at different lung volumes, and while, at fixed lung volumes, displacements of volume were made voluntarily back and forth between the rib cage and abdomen in both the standing and supine postures. The family of isovolume lines was used to construct the volume-motion relationships for the rib cage and abdomen, and this in turn was used to estimate the separate volume changes of these parts during breathing. A high degree of volume dependence between the rib cage and abdomen was demonstrated under isovolume conditions, while a high degree of volume independence between these parts was demonstrated when total volume change was unconstrained. During breathing the chest wall deviated substantially from its passive configuration. In 6 subjects the abdomen accounted for about half or more of the tidal volume, but much less than half of the vital capacity, in both postures. (Authors' Abs.)

511
Laurenzi, G. A., and J. J. Guarneri.
A STUDY OF THE MECHANISMS OF PULMONARY RESISTANCE TO INFECTION: THE RELATIONSHIP OF BACTERIAL CLEARANCE TO CILIARY AND ALVEOLAR MACROPHAGE FUNCTION. Amer. Rev. Respiratory Diseases, v. 93: 134-141, Mar. 1966.

This study describes a precise aerosol system for exposing laboratory animals to air-borne organisms and quantitating the rapid clearance of the inhaled bacteria from the animal's lungs. The high degree of predictability offered by this technique makes it especially adaptable as a reference challenge-response system in the study of pulmonary resistance to infection. In this investigation, smoke inhalation and alcohol administration caused the most marked interference with bacterial clearance. Particle transport studies demonstrated a profound depression of mucociliary function by alcohol. In addition, alcohol interfered with the mobilization of alveolar macrophages from mice exposed to bacterial aerosols. No effect on macrophage metabolism or phagocytosis by alcohol could be demonstrated. This experimental scheme, in which the effects of a test variable on ciliary function and alveolar macrophage activity are related specifically to its effect on bacterial clearance, offers an attractive method of investigation. (Authors' Abs.)

512

Macklem, P. T. and J. Mead.
THE PHYSIOLOGICAL BASIS OF COMMON PULMONARY FUNCTION TESTS. Arch. Environ. Health, v. 14: 5-9, 1967.

The use of pulmonary function tests [in man] which require a forced expiratory maneuver as an index of airway resistance is a gross oversimplification. The flow rates obtained depend on different factors at different lung volumes. Pft (1) is the effective driving pressure over the whole VC [vital capacity], but at high lung volumes the flow it produces is primarily dependent on the cross-sectional area of large airways, whereas at low lung volumes the flow it produces depends primarily on the Rfr [frictional resistance of small airways]. When there are inequalities of distribution of ventilation, additional degrees of complexity are added. Flow rates occurring at high lung volumes will reflect the mechanical properties of the fast spaces, whereas at low lung volumes they will reflect the mechanical properties of the slow spaces. (Biol. Abs.)

513

Macklem, P. T., and J. Mead.
RESISTANCE OF CENTRAL AND PERIPHERAL AIRWAYS MEASURED BY A RETROGRADE CATHETER. Jour. Appl. Physiol., v. 22: 395-401, 1967.

Pressure in airways 1.5-2.5 mm internal diameter was measured in open-chested living dogs and in excised lungs from different species with a "retrograde" catheter extending from the lumen through the bronchial wall, parenchyma, and pleura to the manometer. The pressure was used to partition pulmonary flow-resistance (RL) into a peripheral resistance (R_p) between the catheter and and a central resistance (Rc) between the catheter and the trachea. Peripheral resistance was too small to detect above 80% VC but increased at lower volumes to 15% of RL at 19% of VC. Pulmonary flow resistance increased considerably at low volumes due primarily to an increase in RC. Pulmonary flow resistance increased at high lung volumes, as well, usually due entirely to an increase in Rc. The low value of R_p favors equality of gas distribution, but constriction of peripheral airways might affect gas distribution and exchange with little change in RL. Because lung tissue resistance is included in R_p it must be a negligible component of RL in the dogs studied. (Authors' Abs.)

514

Ogden, E. C., S. Raynor, and V. Hayes.
TRAVELS OF AIRBORNE POLLEN. New York State Univ., Albany. Progress Report No. 7, Mar. 1967, 25p.

This progress report deals with: (1) instrument development, (2) instrument testing and comparison, (3) dispersion studies, (4) variation in pollen concentrations with height, (5) diurnal variations in pollen concentration, (6) prediction of ragweed pollen concentrations, (7) pollen concentrations correlated with meteorological variables, (8) airborne apple pollen, (9) ragweed pollen concentrations in the Adirondack forest, and (10) plans for 1967. (APTIC Abs.)

515

Ramsey, J. M.
POTASSIUM PALLADO SULFITE DETECTION OF CARBON MONOXIDE IN EXHALED AIR AS AN ESTIMATE OF CARBOXYHEMOGLOBIN. Amer. Indus. Hyg. Assoc. Jour., v. 28: 531-534, 1967.

From comparisons of the actual blood carboxyhemoglobin (I) with that calculated from exhaled CO after 20 seconds of holding the breath by using potassium pallado sulfite (II) indicator tubes and polyethylene sampling bags, the overall chi-sq fit was good ($P > 0.79$). The higher segment of the range (8-17% I) showed twice the deviation (3% I) as the 1-8% portion because of the lower accuracy of the II above 50 ppm. The technique has value for checking health risks in CO exposures, but it is not advocated for critical research determinations. (Chem. Abs.)

516

Remenchik, A. P., R. K. Hukkoo, and C. E. Miller.
DETERMINATION OF BODY COMPOSITION BY GAMMA SPECTROMETRY. In: Development of Applied Spectroscopy, v. 5. New York, Plenum Press, 1966, p. 437-458. (Proc. 16th Annual Mid-Amer. Spectroscopy Symposium, Chicago, Ill., June 14-17, 1965)

The use of whole-body counters to assess the potassium content in the human body is discussed. The paper reviews the basic problems of measuring potassium content of the intact organism, one of the measurement techniques which uses a NaI(T1) crystal as a detector, and an analysis of the results that were obtained with this counter. (Authors' Abs.)

517

Richardson, A., J. Robinson, B. Bush, and others.
DETERMINATION OF DIELDRIN (HEOD) IN BLOOD. Arch. Environ. Health, v. 14: 703-708, May 1967.

Two methods for the determination of HEOD (1, 2, 3, 4, 10, 10, hexachloro-6, 7 epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-4 endo, exo-5, 8-dimenthano-naphthalene (Dieldrin)) in blood were assessed. The procedure using acetone as an extraction solvent gives reproducible results and is rapid. The precision of the extraction procedure, as reassured by the coefficient of variation, is of the order of 6%. The accuracy, assessed by comparison with the destructive hydrolysis technique, does not appear to differ signigicantly from 100%. Evidence has been obtained that the concentration of HEOD in the blood of the same person can vary in a random manner from time to time, and the coefficient of variation for samples of blood collected at different times from the same person is about 25%. The acetone extraction procedure is nondestructive and should therefore be applicable to the determination of the organo-chlorine insecticides (particularly those which are unstable to alkalies and their metabolites). (APTIC Abs.)

518

Rylander, R.
CURRENT TECHNIQUES TO MEASURE ALTERATIONS IN THE CILIARY ACTIVITY OF INTACT RESPIRATORY EPITHELIUM [MAN]. Amer. Rev. Respiratory Diseases, v. 93 (Suppl): 67-72, 1966. (Symposium on Structure, Function, and Measurement of Respiratory Cilia, Durham, N. C., Feb. 18-19, 1965).

This paper presents a survey of the general principles of the various methods available for the measurement of ciliary activity. The most commonly employed types of epithelial preparation and exposure methods are outlined. The advantages and disadvantages of each of the above are discussed with respect to different experimental objectives. On the basis of this analysis, recommendations were formulated as to the preferred techniques for each experimental aim. As the tissue-culture technique and the clam technique were described in a previous paper, only these methods are dealt with in this discussion. (Biol. Abs.)

519

Rylander, R.

MEASUREMENT OF DIFFERENT MECHANISMS FOR ELIMINATION OF BACTERIA FROM THE LUNG. Bacteriol. Rev. v. 30: 514-516, Sept. 1966.

Experimental methods used to show the function of the different elimination mechanisms of bacteria from the lung are described. An experimental set-up is suggested whereby the efficiency of the various mechanisms can be measured when the short-term elimination of bacteria from the lungs is being studied. Guinea pigs were exposed for 10 minutes to radioactive nonpathogenic bacteria in a stainless steel exposure chamber. The number of bacteria at various sites in the lung were determined by bacteriological and autoradiographic techniques. The number of bacteria in the whole lung were determined by a grinding technique. The airways were flushed with saline. The lungs were flushed three times via the trachea and the number of bacteria in the fluid determined. On the basis of the work done, it was concluded that most of the E coli that deposit on the mucus are carried upwards out of the lung without prior phagocytosis. The rapid decrease in the number of bacteria found in the washout from the airways is apparently dependent upon the mucus transport. The decrease in the number of viable bacteria in the whole lung preparations is the combined effect of mucus removal and the bacteriocidal effect of the phagocytes. To test the efficiency of the elimination mechanisms, two organisms would have to be used, one of which would be subject to only one of the elimination mechanisms. Spores would be suitable for this purpose. Experiments performed based on this model showed that mucus removal accounts for 15% of the total removal in the first two hours of exposure. (APTIC Abs.)

520

Schuck, E. A., E. R. Stephens, and J. T. Middleton.

EYE IRRITATION RESPONSE AT LOW CONCENTRATIONS OF IRRITANTS. Arch. Environ. Health, v. 13: 570-576, 1966.

The linear relationship between reported eye irritation and formaldehyde concentration in simulated atmosphere experiments does not hold when the formaldehyde concentration is below 0.3 ppm. Subjects may experience equal irritation at irritant concentrations differing by an order of magnitude. From these simulated atmosphere experiments, one can predict that the concentrations of formaldehyde and peroxyacetyl nitrate found in atmospheres polluted with photochemical air pollution can account for most of the detected eye irritation. (Biol. Abs.)

521
Sherwin, R. P., S. Winnick, and R. D. Buckley.
RESPONSE ON LACTIC ACID DENYDROGENASE-POSITIVE ALVEOLAR CELLS IN THE LUNGS OF GUINEA PIGS EXPOSED TO NITRIC OXIDE. Amer. Rev. Respiratory Diseases, v. 96: 319-323, 1967.

A method has been developed for determining the ratio of alveolar cells to alveoli, using lactic acid dehydrogenase reactivity of alveolar cells to identify the cells and gelatin inflation of the lung to permit counting of the alveoli. Ratios have been determined in the lung sections from guinea pigs exposed previously to nitric oxide and have been compared with those of lungs from controls. Significant differences were found between the two animal groups and the ratios within each group have been found to be consistent. (Chem. Abs.)

522
Shleien, B., A. G. Friend, and H. A Thomas, Jr.
A METHOD FOR THE ESTIMATION OF THE RESPIRATORY DEPOSITION OF AIRBORNE MATERIALS. Health Phys., v. 13: 513-517, 1967.

The relation between the concentration of an airborne material present in the environment and its respiratory tract deposition is essential for evaluation of its hazard to health. Because the particle size distribution associated with a toxicant varies with time and at different environmental sites the degree of respiratory deposition for an exposed population is often difficult to assess. Two mathematical models tied together with linear programming techniques are given as a possible solution, The first model is derived from a simple aerosol sizing sampler which shows particle size as a function of filter collection efficiencies; the second shows deposition in the nasal, tracheobronchial, and pulmonary regions as a function of aerosol size. In no case did respiratory deposition total 100% indicating that small particles not trapped in the nasal and tracheobronchial regions of the respiratory tract may be exhaled. The approach to field estimation of the pulmonary deposition of airborne materials yielded reasonable results for selected radionuclides and should prove useful in public health evalution of all particulate air pollution problems. (Chem. Abs.)

523
Sullivan, D. C., D. F. Adams, and F. A. Young.
DESIGN OF AN "ODOR PERCEPTION AND OBJECTIONABILITY THRESHOLD" TEST FACILITY. Atmos. Environ., v. 2: 121-133, Mar. 1968.

The design requirements for the study of the thresholds of odor "perception" and "objectionability" within a large population of human subjects are discussed. The collection of an adequate body of data was facilitated by the conversion of a 35 ft bus into an air-conditioned, mobile odor perception laboratory containing six identical face exposure chambers, each providing a different, known, controlled (and readily changeable) odor concentration. The mobility of the laboratory permits the evaluation of the responses of diverse groups of test subjects at fairs, expositions, elementary schools and universities. A dynamic system of odor generation is used which provides a range of concentrations within the exposure chambers from ppm to at least 1 ppb. Subjects consecutively sample the test atmospheres from the six chambers, each containing a different concentration of the same compound. Ascending, descending and random presentation of concentrations have been employed. Concentrations range from undetectable to detectable by most subjects. The test subjects report, for each chamber, whether or not an odor is "detected" and whether their response to the odor was "pleasant" or "unpleasant". In addition, each subject provides comprehensive information concerning many variables including age, sex, smoking habits, respiratory abnormalities, and occupation. These data are transferred to punched cards and analyzed for possible significant influence upon the response to odor levels. (Authors' Abs.)

524

Wardlaw, S. C., H. D. Kerr, and W. S. Spicer, Jr.
A METHOD FOR DYNAMIC CALIBRATION OF THE WHOLE-BODY PRESSURE PLETHYSMOGRAPHIC SYSTEM. Jour. Appl. Physiol., v. 22: 601-603, Mar. 1967.

A mechanical model is described to facilitate dynamic calibration of the whole-body pressure plethysmograph. The model simulates respiratory maneuvers in a reproducible fashion. It can be used as an unvarying standard for calibrations of the body plethysmograph in measuring the volume of thoracic gas and airway resistance. (Authors' Abs.)

525

Williams, J. D., D. A. Leigh, and G. A. Matthews.
DIAGNOSIS OF EXCESSIVE LEAD ABSORPTION BY USE OF ORAL CALCIUM DISODIUM VERSENATE. Annals of Occupational Hygiene (Oxford), v. 9: 1-5, Jan. 1966.

In order to assume the degree of lead absorption by lead workers 1 g of Versenate was given orally and lead concentration determined in early morning specimens of urine collected before and after the dose. In nonexposed workers only small increases of lead concentration (up to 80 μg/l were found after Versenate. Increasing concentrations of urine lead were found after Versenate in men in whom standard tests for lead absorption showed increasing degree of absorption. Levels of urine lead up to 1500 μg/1 were found in men who were judged by other criteria as fit to continue working whereas when the standard tests showed excessive absorption the lead excretion post Versenate exceeded 1760 μg/l. The results of this test (the Versenate provocation test) were reproducible when it was carried out on twelve men at weekly intervals. It is suggested that this test may prove useful in detecting excessive lead absorption both in lead workers and non-industrially exposed persons. (APTIC Abs.)

526
Xintaras, C., C. E. Ulrich, M. F. Sobecki, and others.
BRAIN POTENTIALS STUDIED BY COMPUTER ANALYSIS.
Arch. Environ. Health, v. 13: 223-232, Aug. 1966.

Photic stimuli were presented to male rats implanted with cortical and subcortical recording electrodes. Cortical potentials evoked in response to each light flash were either averaged online by computer or recorded on a tape recorder for later averaging. Carbon monoxide and pentobarbital induced changes in the response that appeared similar to the changes recorded during the subjects normal transition from wakefulness to spontaneous sleep. Consistent relationships were noted between the spontaneous EEG and the magnitude of the visual evoked response. (Public Health Eng. Abs.)

(c) Epidemiology, Mortality, Morbidity, and Statistics

527
Anderson, D. O.
THE EFFECTS OF AIR CONTAMINATION ON HEALTH:
PART I. Canadian Medical Association Journal (Toronto), v. 97: 528-536, Sept. 1967.

In this first part of three, a survey is made in depth of the problems inherent in the study of the effects of air pollution upon human health. The problems of establishing and evaluating a causal relationship between air pollution and debility are discussed. Sampling problems and the compilation of meaningful statistics according to cogent criteria are also mentioned. The reducing type of pollution (found in London smog) and the oxidizing form (found in Los Angeles smog) are cited as the two major forms of community air pollution. Since disease can be so readily produced by personal and occupational pollution, the problems in elucidating factors in community air pollution leading to disease are multiplied. The health effects of known acute pollution episodes are reviewed. Urban studies in the literature are discussed including special studies (Pittsburgh; Tokyo-Yokohama); studies in London; and results of respiratory surveys (Wales, England, Scotland, Bornholm, the United States, Canada, London). The consensus of the studies is that the accumulated evidence confirms that air pollution constitutes a health hazard. (APTIC Abs.)

528

Anderson, D. O.
THE EFFECTS OF AIR CONTAMINATION ON HEALTH: A REVIEW. PART II. Canadian Medical Association Journal (Toronto), v. 97: 585-593, Sept. 1967.

The literature on the health effects of specific pollutants is reviewed. Included are studies on dustfall, sulfur dioxide, oxidizing pollution (as a mixture, or when broken into these components: carbon monoxide, oxides of nitrogen, ozone, and peroxyacetyl nitrate), polycyclic hydrocarbons, industrial sources of community air pollution (especially arsenic, beryllium, and asbestos), and several other pollutants. The effects of low levels of common air pollutants, classified as particulate matter, irritants, oxidants, and systematic poisons, are not known precisely. According to one study, high and significant correlations were obtained between lung cancer mortality in men, and levels of beryllium, arsenic, zinc, molybdenum, vanadium, cobalt, manganese, lead, and titanium. No correlation was observed for nickel and antimony. In terms of magnitude of the effect, the hazard of long-term exposure to levels of urban pollution is much less than that of personal air pollution by cigarette smoking. The biological effect, however, is similar to that of smoking, and is documented in excess mortality, respiratory conditions, and possibly also in respiratory cancer. The most important constituent currently measured in the air is dust. (APTIC Abs.)

529

Anderson, D. O.
THE EFFECTS OF AIR CONTAMINATION ON HEALTH:
PART III. Canadian Medical Association Journal (Toronto), v. 97: 802-806, Sept. 1967.

Several topics related to human health and air pollution are discussed: the psychosocial impact of pollution, the vehicular accident hazard of air pollution, air quality levels and human tolerance, and some specific Canadian research into the health hazards of air pollution. The person most sensitive to pollution is the person already debilitated by chronic respiratory disease and associated cardiovascular disease. Reversible physiological responses to pollutants in housewives and preschool and school-aged children might be used to set levels which can be incorporated into air quality standards. The setting of standards in Russia, which, however, are not operational, is briefly discussed. A study of the health hazards of pollution should include its impact upon human ecology, man's society, and upon individual psychological adjustment. (APTIC Abs.)

530

Bartlett, D. B., Jr., and R. E. Carroll.
AIR QUALITY PARAMETERS FOR EPIDEMIOLOGIC STUDIES.
Arch. Environ. Health, v. 16: 182-187, Feb. 1968.

A discussion of the problems which arise when atmospheric pollution is related to health is presented. Classifications for the pollutants are suggested and the necessity of increasing discrimination in the use of parameters of air quality that are biologically meaningful is discussed. Our understanding of quantitative relationships between concentrations of air pollutants and their effects on man is quite primitive. Host factors, such as allergy, resistance to infection, and preexisting disease are easily mentioned, but are measured with considerable difficulty and little precision.

531

Bouhuys, A., L. J. Heaphy, Jr., R. S. F. Schilling and others.
BYSSINOSIS IN THE UNITED STATES. New England Jour. Med., v. 277: 170-175, July 1967.

A study of 21 male cotton workers with chronic respiratory disease from Tennessee, North Carolina, and South Carolina, suggests that byssinosis is not a minor problem in the U. S. and that an investigation of the prevalence of byssinosis is urgently needed. Byssinosis is an occupational respiratory disease of cotton, flax, and hemp workers, occurring primarily among employees of the cardroom. It is characterized initially by tightness in the chest, dyspnea and cough shortly after return to work on Mondays and accompanied by a decreased ventilatory capacity during the working day. All the cotton workers examined (who had many years' exposure in cardrooms) had byssinosis and more than one half were respiratory cripples. Eight workers from other departments did not have byssinosis and only one had severe ventilatory insufficiency. Byssinosis is not disappearing despite increased mechanization and better dust control, since the higher productivity has increased the dustiness and neutralized the improvement brought about by air conditioning. Among the measures recommended are: adequate dust removal; exclusion of applicants with existing obstructive airway disease; and the identification of reactors by the measurement of the F. E. V.$_{1.0}$ on new employees before and after work on Monday. (APTIC Abs.)

532
Carroll, R. E.
THE RELATIONSHIP OF CADMIUM IN THE AIR TO CARDIOVASCULAR DISEASE DEATH RATES. Jour. Amer. Med. Assoc., v. 198: 267-269, Oct. 1966.

The average concentration of cadmium in the air of the 28 cities for which data are available shows a marked correlation with death rates from hypertension and arteriosclerotic heart disease (coefficient of correlation [r] = 0.76). This association cannot be explained by a tendency of large, industrialized cities to have both high heart disease rates and heavily polluted air, since there is no correlation with indexes of air pollution in general. It is hypothesized that cadmium is a significant cause of hypertension and perhaps of a portion of the rest of the cardiovascular disease spectrum. (APCA Abs.)

533
Cederlof, R., M. L. Edfors, L. Friberg and others.
HEREDITARY FACTORS, "SPONTANEOUS COUGH" AND SMOKERS'S COUGH:" A STUDY ON 7,800 TWIN-PAIRS WITH THE AID OF MAILED QUESTIONNAIRES TOBACCO. Arch. Environ. Health, v. 14: 401-406, 1967.

Questionnaires were mailed to 2,793 monozygotic and 5,008 dizygotic unselected twin-pairs, 40 to 80 years old. In nonsmoking twin-pairs, the concordance rate for the symptom "spontaneous cough" was 1.25% for monozygotic twin-pairs compared with 0.63% for dizygotic twin-pairs. This significant difference in concordance rates demonstrates a genetic influence on the development of the symptom. The concordance rate of "spontaneous cough" or "smoker's cough" or both in smoking monozygotes was considerably higher than expected. The development of "smoker's cough" is probably either more strongly influenced genetically than the development of "spontaneous cough" or is genetically dependent on the development of "spontaneous cough." In analyzing the data from monozygotes with discordant smoking habits, the twin-series was divided with regard to the prevalence of symptoms in the nonsmoking twin, forming 2 subgroups (with and without the symptom). The observed prevalence rates for the smokers were higher than expected in the low as well as in the high risk group, the hypermorbidity ratios being 3 and 1.5 respectively. Due to the intrapair correlation among nonsmoking monozygotes, the expected values differed considerably between the risk-groups, being 6 times greater in the higher risk group than in the lower. The observed value for smokers in the low risk group was only 1/2 of that expected for nonsmokers in the high risk group, demonstrating that for the individual the genetic influence is relatively more important in the development of cough than is smoking. At the population level the "high risk group" is relatively small. This means that the total effect of a "susceptible constitution" for the population at large will be considerably smaller than the effect of tobacco. The figures reported concern the unspecific symptom "cough" and the generalization to more severe symptoms and to the prognosis requires further investigation. (Biol. Abs., Modified)

534

Cederlof, R., L. Friberg, and E. Jonsson.
HEREDITARY FACTORS AND "ANGINA PECTORIS": A STUDY OF 5.877 TWIN-PAIRS WITH THE AID OF MAILED QUESTIONNAIRES. Arch. Environ. Health, v. 14: 397-400, 1967.

The role of genetic factors in the development of coronary heart disease as evaluated by means of a mailed questionnaire was investigated. The subjects comprised 2,255 monozygotic and 3,622 dizygotic unselected twin-pairs, 40 to 80 years old. The method for diagnosing "angina pectoris" was based on a questionnaire elaborated by Rose and recommended by WHO [World Health Organization] for epidemiological use. A higher concordance rate among monozygotic twin-pairs with regard to "angina pectoris" compared to dizygotic twin-pairs (40 to 60 years old: 9.2% among MZ [monozygotes] vs 2.9% among DZ [dizygotes]; 60 to 80 years old: 21.7% among MZ vs 6.1% among DZ) was reported. The differences speak strongly in favor of the existence of a genetic predisposition for the development of angina pectoris. (Biol. Abs.)

535

Cederlof, R., L. Friberg, E. Jonsson and others.
RESPIRATORY SYMPTOMS AND "ANGINA PECTORIS" IN TWINS WITH REFERENCE TO SMOKING HABITS. Arch. Environ. Health, v. 13: 726-737, 1966.

The statistical association between smoking and respiratory and coronary symptoms as evaluated with the aid of questionnaires mailed to a sample of firstborn twins from the Swedish population is investigated. The study was carried out on monozygotic and dizygotic twin pairs where one twin was a smoker and the cotwin a nonsmoker (twin-control method). The investigation was based on a population of about 12,900 twin pairs, in principle covering all same-sex twin pairs born in Sweden during 1886 to 1925, provided that both twins in each couple were still alive. Information about the twins' smoking habits and a crude measure of their residential history, as well as about their medical and sociological data was obtained by questionnaires mailed to them. Complete information was obtained from 9230 twin pairs, of whom 1924 were discordant with regard to smoking habits. Three symptoms were considered, namely, "cough," "bronchitis," and "angina pectoris." Diagnoses were based on response to a certain array of questions. A statistical association between smoking and symptoms was found with regard to "cough" and "bronchitis" as well as "angina pectoris" when the investigational material was regarded as a population sample (only the firstborn twin in each pair was considered). The statistical association between smoking and symptoms persisted with regard to "angina pectoris" when the investigational material was treated according to the twin-control method, that is, considering twin pairs where the one partner was a smoker and the co-twin a nonsmoker. Hypermorbidity in respiratory symptoms among smokers in the population sample is in good agreement with other reports. The hypermorbidity in "angina pectoris" among smokers in the population sample of firstborn twins is of the same order of magnitude as in other reports in regard to hypermortality—hypermorbidity investigations being sparse and not unanimous. The fact, however, that a corresponding morbidity could not be found among smokers in smoking-discordant twin pairs by use of the twin-control method speaks against a causal interpretation and favors a theory of constitutional factors playing an important part in the development of "angina pectoris." (Authors' Abs., Modified)

536

Cederlof, R., E. Jonsson, and T. Lundman.
ON THE VALIDITY OF MAILED QUESTIONNAIRES IN DIAGNOSING "ANGINA PECTORIS" AND "BRONCHITIS". Arch. Environ. Health, v. 13: 738-742, 1966.

In an epidemiologic investigation on about 10,000 twin-pairs, information about "angina pectoris" and "bronchitis" was obtained with the aid of mailed questionnaires, using modifications of Rose's "chest-pain questionnaire" as well as the British Medical Research Council's questionnaire on bronchitis. A comprehensive clinical examination, including an exercise test and a lung function test, was performed on a selected subsample of 336 individuals. A comparison between the "questionnaire diagnosis" and clinical diagnosis is reported, as are the 3-year crude mortality figures for 10,000 individuals in the twin-population, broken down by the presence of certain symptoms. Of 8 male patients with conditions diagnosed as "angina pectoris" according to the mailed questionnaire, 4 (50 percent) were confirmed at the clinic as manifest cases. Among 204 male respondents not displaying the symptom according to the questionnaire, 2 (1 percent) were clinically positive. The figures for "bronchitis" revealed an association with an abnormal lung function test of about the same magnitude for both men and women. The mortality figures demonstrate a highly significant dependence on the presence of "angina pectoris" as well as "bronchitis. (Biol. Abs.)

537

Duffy, E. A., and R. E. Carroll.
UNITED STATES METROPOLITAN MORTALITY 1959-1961. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 203p. (PHS Publ. No. 999-AP-39)

The five death tables presented are: Table 1 - Observed deaths and indirect age-adjusted expected deaths and yearly rates per 1000,000; Table 2 - Standard Metropolitan Statistical Areas (SMSA) 1960 live births and 1960 census enumeration by age, color, and sex; Table 3 - Infant and neonatal deaths and mortality rates per 1,000 live births by SMSA, color, and sex; Table 4 - Deaths and death rates per 100,000 per year by SMSA, cause, and age (a. White males, b. White females, c. Non-white males, and d. Non-white females); and Table 5 - Total deaths and death rates per 100,000 by SMSA, color, and sex.

538

Ferris, B. G., Jr., W. A. Burgess, and J. Worcester.
PREVALENCE OF CHRONIC RESPIRATORY DISEASE IN A PULP MILL AND A PAPER MILL IN THE UNITED STATES. British Journal of Industrial Medicine (London) v. 24: 26-37, 1967.

A sample of 147 men drawn from the workers in a pulp mill was compared with one of 124 men from a paper mill. The former included those exposed to chlorine and to sulfur dioxide. No significant differences were found in respiratory symptoms or in simple tests of ventilatory function in the two samples, but men working in chlorine had a somewhat poorer respiratory function and more shortness of breath than those working in sulfur dioxide. The working population of both mills together had a lower prevalence of respiratory disease than that of the male population of Berlin, New Hampshire, previously studied, suggesting that working populations may not be representative of the general population. Further, a low prevalence of disease in a working population exposed to pollutants may not indicate their safety in general populations. (Authors' Abs.)

539
Ferris, B. G., Jr. and J. L. Whittenberger.
ENVIRONMENTAL HAZARDS: EFFECTS OF COMMUNITY AIR POLLUTION ON PREVALENCE OF RESPIRATORY DISEASE.
New England Jour. Med., v. 275: 1413-1419, Dec. 1966.

Selected research concerning air pollution and its effect on human health is reviewed, and the limitation of these data is discussed critically. Any attempt to assess the effect of atmospheric pollution on human health eventually requires studies of human populations. Chronic exposure of human subjects under laboratory conditions is impractical and potentially unethical; as a result, one is forced to turn to surveys in general or selected populations. A certain amount of air pollution will always be a part of man's environment. The levels that will be considered acceptable will depend on what the public decides is an acceptable level of disease or disability in the community and what is an acceptable interference with the aesthetic quality of the atmosphere. The controls necessary to realize this level should be considered a part of the costs of production for which the consumer will eventually pay. Every effort should be made to limit the levels of atmospheric pollution before more serious harm to human health is done. Certainly, the levels should not be allowed to rise. In some communities they are already above what will probably be demonstrated as acceptable, and measures should be taken to reduce them. The controls required in each community will be different and those to be instituted should be based upon a careful analysis of the composition and sources of pollutants. Three tables concerning responses to questions regarding smoking and phlegm, prevalence of symptom of chest illness-past 3 years and prevalence of dyspnea, Grade II or more are included. Three figures concerning the relation of prevalence of selected symptoms and sulfation rates, ages 45 to 64 and standardized for age, relation of prevalence and mean sulfation rate, ages 45 to 64, standardized for age and lifetime cigarette consumption and observed and expected values of forced epiration volume in one second (1-second timed vital capacity) in liters are also included. (APTIC Abs.)

540
Ferris, B. G., Jr., and J. Worcester.
MORTALITY IN A MOVIE PROJECTIONIST UNION IN BOSTON, 1910-64. British Journal of Industrial Medicine (London), v. 24: 178-180, 1967.

An examination of the mortality experience of the members of a movie projectionist union in the United States has revealed no significant difference between the group that entered prior to 1940 and the group that entered after 1940, nor was their mortality experience greater than that of the general population. It is concluded, therefore, that the possible different levels of exposure of the two groups to the gases and fumes from carbon arcs and to the heat stresses did not contribute significantly to their mortality. (Authors' Abs.)

541

Friberg, L. and R. Rylander.
[SWEDISH MEDICAL AIR QUALITY GUIDES] Medicinska rekommendationer rörande luftrenhetsnormer. Nordisk Hygienisk Tidskrift (Köbenhavn), v. 46: 1-32, 1965.

An attempt to develop medical air quality guides was made by a committee formed on the initiative of the National Air Conservation Committee. The national air pollution situation was discussed, a survey of the literature performed and data was discussed in regard to its validity in the prevailing air pollution situation in Sweden. Levels of SO_2 in big cities in Sweden were at times fairly close to the values where damage has occurred in other countries. Numerical guides were suggested for concentration of SO_2 and carbon monoxide. For metals, carcinogenic and mutagenic substances and pollutants causing sanitary problems the committee did not suggest numerical guides, but recommended that the concentrations of such substances should be kept as low as possible. (Biol. Abs.)

542

Glasser, M., L. Greenburg, and F. Field.
MORTALITY AND MORBIDITY DURING A PERIOD OF HIGH LEVELS OF AIR POLLUTION. Arch. Environ. Health, v. 15: 684-694, Dec. 1967.

The patterns of mortality and morbidity during a recent episode of high air pollution in New York which occurred during the Thanksgiving Day weekend, Nov. 23 to 25, 1966 are examined. With the onset of high levels of air pollution, daily deaths due to all causes immediately rose to higher than expected levels, and remained at higher than expected levels for seven consecutive days. There were 24 more deaths per day than during the control periods. Thus, in all there was a total of 168 excess deaths. The excess number of deaths per day was observed in each of the three age groups studied. This excess increased with increasing age. Significant increases in the number of deaths were observed on one or more days for arteriosclerotic heart disease, vascular lesions of the central nervous system, malignant neoplasms of the respiratory system, the category "other diseases of the circulatory system" and the miscellaneous group "all other causes." The timing and duration of the observed increases varied by cause of death. Because the weather was unseasonably warm during the air pollution episode, daily death patterns of another warm spell characterized by normal levels of pollution were examined. It was concluded that the rise in temperature at the time of the episode could not account for the observed increase in mortality, although it might have been a contributing factor. The number of emergency clinic visits for bronchitis and asthma at seven large New York hospitals was examined. There was a rise in the number of such visits on the third day of the episode, among patients age 45 and over, at three of the seven hospitals investigated. Unfortunately, the Thanksgiving Day holiday greatly complicated this portion of the study. The data available do not make it possible to evaluate the contribution, if any, of the Thanksgiving Day holiday to the observed rise in emergency clinic visits. (APTIC Abs.)

543

Goldsmith, J. R.

ENVIRONMENTAL EPIDEMIOLOGY AND THE METAMORPHOSIS OF THE HUMAN HABITAT. Amer. Jour. Public Health, v. 57: 1532-1549, Sept. 1967. (Presented at: American Public Health Assoc., 94th Annual Meeting, San Francisco, Calif., Nov. 3, 1966.).

Environmental epidemiology, the evaluation of the effects of environmental agents and attributes on human populations inadvertently exposed, is not a new discipline. Because of the many changes occurring in the type and extent of these exposures it assumes new importance. Two strategies are proposed for applying the results of environmental epidemiology. Strategy A--To collect and present quantitative data on realistic human exposures and effects which are of sufficient predictive validity to be used as satisfactory bases for public health policies and regulations. Strategy B--In the absence of information of sufficient predictive validity on effects of realistic exposures, to collect data for exposures of greater intensity and duration than normally occur. When applied to radiation exposure problems, the present situation is most clearly described by Strategy B, but studies are suggested whose results might permit the use of Strategy A. Carbon monoxide control from motor vehicle exhaust is based on Strategy A. Possibly some of the health effects from cigarette smoking are also related to carbon monoxide exposure. Psychomotor effects from low-level short-term exposures should be studied, as well as effects of long term exposures on red blood count and hemoglobin metabolism from long-term exposure. Sulfur oxides occur commonly with soot in polluted urban areas, particularly under conditions prevalent in London. Epidemiological studies permit use of Strategy A for acute effects and Strategy B for long-term effects. Control of particulates is more easily accomplished than control of sulfur oxides, the long-term effects of which are still in need of study. Both increases and decreases in the outdoor temperature are associated with measurable, possibly preventable health effects, the former with increased deaths especially from vascular accidents in the elderly, and the latter, among other effects, with increased attack rates from asthma. Strategy A would be appropriate. These examples illustrate the potential usefulness of increased emphasis on environmental epidemiology. (Author's Abs.)

544

Goldsmith, J. R., Jr. and A. C. Hexter.
RESPIRATORY EXPOSURE TO LEAD: EPIDEMIOLOGICAN AND EXPERIMENTAL DOSE-RESPONSE RELATIONSHIPS. Science, v. 158: 132-134, Oct. 1967.

The relative importance of respiratory exposures to lead is discussed. Epidemiologic studies of blood lead levels in general and occupational groups show a logarithmic regression on estimated atmospheric exposure. Experimental results at the same and higher levels show a dose-response relationship which fits the same regression. The data imply that long-term increases in atmospheric lead will result in predictably higher blood lead levels in the exposed populations. (APTIC Abs.)

545

Greenburg, L., F. Field, C. L. Erhardt and others.
AIR POLLUTION, INFLUENZA, AND MORTALITY IN NEW YORK CITY. JANUARY-FEBRUARY, 1963. Arch. Environ. Health. v. 15: 430-438, 1967.

A period of intense air pollution from Jan. 29 to Feb. 12, 1963, in the city of New York was investigated. During this period, 809 deaths were noted in excess of the overall average number of deaths for the same 15-day periods in the years 1961, 1962, 1964, and 1965. Three control periods were used: the days prior to and subsequent to the episode, a similar period of 15 days during 1958, and the days prior to and subsequent to the period of 1958. During these control periods, influenza and cold weather were present but air pollution was not. Estimates of the effect of air pollution ranged from approximately 200 to 400 excess deaths. The increase in mortality during the critical period, Jan. 29 through Feb. 12, 1963, took place among the older age groups (45 to 64 and 65 and over. (Authors' Abs.)

546
Greenburg, L., F. Field, J. I. Reed and others.
ASTHMA AND TEMPERATURE CHANGE. II. 1964 AND 1965 EPIDEMIOLOGICAL STUDIES OF EMERGENCY CLINIC VISITS FOR ASTHMA IN THREE LARGE NEW YORK CITY HOSPITALS. Arch. Environ. Health, v. 12: 561-563, May 1966.

The daily numbers of emergency clinic visits for asthma were obtained at three large hospitals in New York City for Sept. 1964 and 1965. One of the results of these studies was recognition of the increase in the number of asthma visits to emergency clinics with the onset of cold weather. This study substantiates the findings of other experimental work on the effects of cold air on ventilatory function, but no definitive causal relationship has been established. Cold stress on asthmatics appears to be a subject worthy of further investigation. Two tables showing average daily number of emergency visits for asthma Sept. 1964, 1965, and mold and pollen counts, Brooklyn, N.Y., Sept. 1964, 1965 are included. (APTIC Abs.)

547
Greenburg, L., J. I. Reed, and M. Glasser.
AIR POLLUTION AND CANCER MORTALITY. STUDY ON STATEN ISLAND (BOROUGH OF RICHMOND), NEW YORK. Arch. Environ. Health, v. 15: 356-361, Sept. 1967.

A study of cancer mortality in relation to air pollution on Staten Island (Borough of Richmond), New York is discussed. Mortality records for the years 1959, 1960, 1961 by age, sex, and race were obtained from the New York City Department of Health. Age-adjusted death rates for white males and white females were calculated for all causes of death; all causes of death excluding accidents, suicides, homicides, and malignant neoplasms of the respiratory tract; and malignant neoplasms of all sites excluding those of the respiratory system. The total number of deaths in Staten Island due to malignant neoplasms in 1959 through 1961 was 1,190. It was found that the incidence of total cancer mortality excluding the respiratory system appears to be unrelated to the location of the health district. More important, mortality from malignant neoplasms of the respiratory system did show higher rates in the "probably high air pollution" areas compared to the "probably low air pollution" areas. Data with reference to certain socio-economic indices in the health areas under study was obtained. The percentage of families with annual income of less than $4,000 for the year 1959, the range in the proportion of housing classified as delapidated for the year of 1960, and the range of the median years of school completed among whites, 25 years of age and over, for the year 1960 are presented. It appears from these data that the "probably high air pollution" areas are inhabited by families of lower socio-economic status than the probably low health areas. Differences between the high and the low areas may, therefore, be due in part to socio-economic factors. (APTIC Abs.)

548

Hagstrom, R. A., H. A. Sprague, and E. Landau.
THE NASHVILLE AIR POLLUTION STUDY. VII. MORTALITY FROM CANCER IN RELATION TO AIR POLLUTION. Arch Environ. Health, v. 15: 237-248, Aug. 1967.

Mortality from various types of cancer was analyzed by level of air pollution in a segment of the population relatively homogenous with respect to socioeconomic factors. The objectives were to determine mortality rates for cancer in the tracted area of the Nashville, Tenn. Standard Metropolitan Statistical Area (SMSA); to study the relation between cancer mortality and the demographic, social, and economic characteristics of the population in the tracted area of the Nashville SMSA; to determine whether cancer mortality varies with exposure in the residential environment to different levels of atmospheric pollution. All deaths due to malignant neoplasms in the Nashville SMSA for the years 1949 through 1960 were classified by pollution level and socio-economic category in a manner identical to that for deaths due to respiratory diseases. The socioeconomic status of each decedent was considered to be that of the census tract in which he resided at the time of death. He was considered also to have been exposed to a level of pollution similar to the tract in which he resided at the time of death. Results of the study are presented for various types of cancer. This analysis points to the need for additional studies designed to control such factors as smoking, occupation, and the like. (APTIC Abs.)

549

Kenline, P. A.
OCTOBER 1963 NEW ORLEANS ASTHMA STUDY. Arch. Environ. Health, v. 12: 295-304, 1966.

This paper reports on aerometric activities carried out in New Orleans from Oct. 3 through Nov. 5, 1963. The objectives of these activities were to establish any difference in air quality between asthma outbreak days and other days, evaluate geographic and temporal variation in pollution characteristics, and evaluate various uncommon methods of measuring air pollution. (Author's Abs.)

550

Kessner, D. M. and M. H. Lepper.
EPIDEMIOLOGIC STUDIES OF GRAM-NEGATIVE BACILLI IN THE HOSPITAL AND COMMUNITY. Amer. Jour. Epidemiol., v. 85: 45-60, 1967.

Data from a preliminary survey show a gram-negative bacillary rate of 45.0/1000 patients. The main survey involved a clinical and bacteriological analysis of 1589 patients hospitalized from Oct. 1960 to Aug. 1961. These patients were contrasted with 471 community patients comprising a potentially infected population from the Visiting Nurse Association of Chicago and a carrier population attending the Cancer Prevention Center of Chicago, Inc. The gram-negative bacillary infection rate was 63.9/100 hospitalized patients; 5% of the community population had community-acquired infection. Of 19 different species (2915 strains) of gram-negative rods identified, 89% consisted of the following: Escherichia coli, 31.5%; Klebsiella, 17.3%; Pseudomonas, 15.9%; Proteus mirabilis, 13.4%; Aerobacter, 8.19% and Herella, 2.8%. A dearth of Klebsiella species was observed in all community non-enteric culture sites; Klebsiella accounted for 19.4% of hospital urinary track strains and only 1.3% of community organisms. In non-enteric and non-urinary tract sites it comprised only 0.7% of community strains but 11.8% of the hospital organisms. Antibiotic therapy did not appear to influence the species distribution of gram-negative rods. (Biol. Abs.)

551

McCarroll, J.

MEASUREMENTS OF MORBIDITY AND MORTALITY RELATED TO AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 17: 203-209, Apr. 1967.

The examination of total deaths in New York City by the day of occurrence shows periodic peaks in mortality which are associated with periods of high air pollution. The investigation suggests that the mechanism is probably protean and pervasive, affecting the course of a variety of different diseases through basic physiologic effect. The relationship of morbidity in normal urban population to air pollution is demonstrated by a time series analysis of correlation coefficients. The relation of cough and eye irritation in a group of 1090 persons observed for three years is compared with measurements of SO_2 and particulate density to which they were exposed. Time lags of up to 28 days were introduced. (Eng. Index)

552

Peters, J. M. and B. G. Ferris, Jr.

MORPHOLOGICAL CONSTITUTION AND SMOKING: A FURTHER EVALUATION. Arch. Environ. Health, v. 14: 678-681, 1967.

A total of 1972 Harvard College students from the classes of 1964 and 1965 was investigated with regard to smoking habits and health. Among other variables, height and weight were examined. There were no significant differences found between smokers and nonsmokers in height and weight. There were significant differences in age and religious categories between smoking groups. Nonsmokers were younger and contained more Jews than smokers. (Authors' Abs.)

553

Peters, J. M. and B. G. Ferris, Jr.
SMOKING AND MORBIDITY IN A COLLEGE-AGE GROUP. Amer. Rev. Respiratory Diseases, v. 95: 783-789, May 1967.

Because of limited information on the effects of smoking on young persons, an investigation was made on smoking and morbidity among students who graduated from Radcliffe and Harvard in 1964 and 1965. Medical charts furnished a record of visits to the clinic of 1623 Harvard graduates and 404 Radcliffe graduates. The total clinic visits were divided into respiratory disease, gastrointestinal disease, traumatic disease, and genitourinary disease (Radcliffe only). Smokers were identified by their entrance physical examination and a questionnaire prior to graduation. The frequency and severity in the total disease category were greater in the smoker than in the nonsmoker. There was highly significant positive correlation between years smoked and increase in traumatic disease in Harvard and genitourinary disease in Radcliffe. Substantial evidence exists to indicate direct causation between smoking and increased respiratory disease, although this cannot be stated categorically. The relationship between smoking and increase in traumatic and genitourinary disease is most likely complicated by various personality and social factors. (APTIC Abs.)

554

Peters, J. M., and B. G. Ferris, Jr.
SMOKING, PULMONARY FUNCTION, AND RESPIRATORY SYMPTOMS IN A COLLEGE-AGE GROUP. Amer. Rev. Respiratory Diseases, v. 95: 774-782, May 1967.

This study was intended to assess respiratory symptoms and to determine any measurable pulmonary effects of smoking in the young adult. The information would be useful in the study of chronic nonspecific pulmonary disease and in suggesting to the young person that if early damage was found it was a matter of immediate concern. The study was performed on a group of 124 Harvard seniors who completed a questionnaire on respiratory symptoms and performed some simple tests of pulmonary function. By the use of a Stead-Wells spirometer the following indices were obtained for each student: the vital capacity (VC), and forced expiratory volume in one second (FEV_1), the ratio of FEV_1/VC, and the flow rate 75, 50, 25, and 10% of the vital capacity ($FR_{75\%}$, $FR_{50\%}$, $FR_{25\%}$, and $FR_{10\%}$). The Wright peak flowmeter was used to obtain flow rates at 90% of vital capacity ($FR_{90\%}$). Smokers were found to have more cough in the winter (10.8 vs 0%), more morning phlegm in the winter (21.7 vs 0%), more periods of increased phlegm production lasting three months or more (26.5 vs 2.4%). The smokers had a greater frequency of breathlessness, wheezing, and colds than did the nonsmokers. Smoking in a college-age group was associated with functional changes compatible with the first stage of chromic nonspecific respiratory disease (emphysema and/or chronic bronchitis). (APTIC Abs.)

555
Petrilli, F. L., G. Agnese, and S. Kanitz.
EPIDEMIOLOGIC STUDIES OF AIR POLLUTION EFFECTS IN GENOA, ITALY. Arch. Environ. Health., v. 12: 733-740, 1966.

The topography and air pollution emissions of the town of Genoa, Italy are described and some results of 10 yr of air pollution monitoring are enclosed. Several epidemiological researches were carried out to emphasize a correlation between air pollution and frequency of lung cancer and other respiratory diseases. The results of some studies are reported, especially those which revealed significant differences in the frequency of respiratory symptoms and new cases of bronchitis in population samples living in districts with different air pollution problems; the meaning of these observations is discussed. (Biol. Abs.)

556
Sterling, T. D., J. J. Phair, S. V. Pollack, and others.
URBAN MORBIDITY AND AIR POLLUTION. I. Arch. Environ. Health, v. 13: 158-170, 1966.

The relationship between level of pollutants in air and incidence of illness was investigated at the community level for several air pollutants and for a number of diseases. The rate of hospital admission was used as an index of intensity of illness. The fluctuation of hospital admissions showed a very definite preference for certain days of the week and a marked avoidance of others. The level of various pollutants is also subject to the influence of day of the week due to industrial schedules (driving patterns), therefore, the overall effect appeared to be one of cancellation so that the net correlation between pollution level and health was effectively zero. Validity of the analyses was insured by correcting for the effect of day of the week to hospital admission data prior to examination for possible effects of pollutant levels. It was seen that the correlations between fluctuations in air pollution and morbidity were, extremely high. (Biol. Abs.)

557

Sterling, T. D., S. V. Pollack, and J. J. Phair.
URBAN HOSPITAL MORBIDITY AND AIR POLLUTION. (A SECOND REPORT). Arch. Environ. Health, v. 15: 362-374, Sept. 1967.

This analysis deals with morbidity as indicated by the length of stay in the hospital of admitted patients. Length of stay represents a measure of adversity of illness which might be more indicative of stresses encountered than admission rate in itself. Also, responsiveness of a hospital patient to a particular pollutant can be related meaningfully especially if the latter is measured in close proximity to the place of confinement. This method may be more sensitive than studying hospitalized cases coming from various areas of the city, albeit that the service areas of individual hospitals have a tendency to be fairly restricted and specific. The investigators were given access to large data-sets in Cincinnati, Ohio and Los Angeles, California. The data were in such a form that they could readily and cleanly be processed by automatic data equipment. The Cincinnati data recorded accorded them the opportunity to test out some of their hypotheses on a relatively small volume of data. Additionally, they were able to develop the relevant computer techniques and programs. The acquired facility, in understanding and technique was then applied to the more voluminous Los Angeles data. This report concerns itself with the analysis of the relation between air pollution and length of stay of patients in the larger Los Angeles hospitals serving Blue Cross admissions. (APTIC Abs.)

558

Treshow, M.
PLANT COMMUNITIES MENACED BY POLLUTED AIR. Conservation Catalyst, v. 2: 7-9, 1967.

Postmortem evaluations of air pollution damaged plants and base line evaluations before the air pollution situation becomes critical are the two approaches to the study of air pollution effects on plants. The value of these studies lies in enabling man to avoid the precipitation of irreversible environmental changes which might take an exceedingly long time to correct. The recognition and evaluation of the impact of environmental disturbances is of great importance.

559

Winkelstein, W. Jr., and S. Kantor.
SOME OBSERVATIONS ON THE RELATIONSHIPS BETWEEN AGE, SEX, AND BLOOD PRESSURE [HUMAN]. In: The Epidemiology of Hypertension. New York, Grune and Stratton, 1967, p. 70-81. (Proc. Internat. Symposium, Chicago, Ill., Feb. 3-7, 1964).

The sampling and interpretation of epidemiological data on blood pressure studies is discussed. (Biol. Abs.)

560

Winkelstein, W. Jr., S. Kantor, E. W. Davis, and others.
THE RELATIONSHIP OF AIR POLLUTION AND ECONOMIC STATUS TO TOTAL MORTALITY AND SELECTED RESPIRATORY SYSTEM MORTALITY IN MEN: I. SUSPENDED PARTICULATES. Arch. Environ. Health, v. 14: 162-171, 1967.

Data are presented from the Erie County [New York, USA] Air Pollution Respiratory Function Study which show a positive association between air pollution level and total mortality among white men age 50-69 when economic factors are controlled. The relationship persists, although greatly attenuated in those 70 years of age and over. Among white women the same pattern is evident. For chronic respiratory disease, a positive association is demonstrated for white men 50-69 years of age. No association between air pollution and cancer of the bronchus, trachea, and lung is evident in these data. (Authors' Abs.)

561

Zeidberg, L. D., R. J. M. Horton, and E. Landau.
THE NASHVILLE AIR POLLUTION STUDY: V. MORTALITY FROM DISEASES OF THE RESPIRATORY SYSTEM IN RELATION TO AIR POLLUTION. Arch. Environ. Health, v. 15: 214-225, Aug. 1967.

The plan of a study of respiratory disease mortality in relation to air pollution, designed to evaluate socioeconomic factors as well as degree of exposure to air pollutants, is described. Mortality from respiratory disease varied inversely with the socioeconomic class, when the degree of exposure to air pollutants was kept constant except for lung and bronchial cancer. For the middle socioeconomic class population, as defined, respiratory disease mortality was directly related to the degree of exposure to sulfation and soiling, except for lung and bronchial cancer, and for bronchitis and emphysema. Age-specific respiratory disease mortality from 25 to 75 years of age was directly related to the degree of exposure to sulfation. At all levels of exposure to sulfation respiratory disease mortality for men was higher than for women. The difference was especially marked for lung and bronchial cancer mortality. With the exception of lung and bronchial cancer, respiratory disease mortality for nonwhites was higher than for whites at high and moderate levels of exposure to sulfation. The deviation of mortality for lung and bronchial cancer, and for bronchitis and emphysema from the pattern shown by other respiratory diseases is discussed. (Authors' Abs.)

562

Zeidberg, L. D., R. J. M. Horton, and E. Landau.
THE NASHVILLE AIR POLLUTION STUDY: VI. CARDIOVASCULAR DISEASE MORTALITY IN RELATION TO AIR POLLUTION. Arch. Environ. Health, v. 15: 225-237, Aug. 1967.

The plan of a study of cardiovascular disease mortality in relation to air pollution, designed to evaluate socioeconomic factors as well as degree of exposure to air pollutants, is described. When the degree of exposure to air pollutants was kept constant a generally regular pattern of an inverse relationship between socioeconomic class and mortality rates for cardiovascular diseases was observed for the Nashville SMSA for a 12-yr period, 1949 to 1960. An exception was arteriosclerotic heart disease which showed a direct relationship. Of the four pollutants studied for their association with cardiovascular mortality, the most consistent pattern was noted for suspended particulate matter as measured by the soiling index. No explanation is at hand for this observation. For the middle socioeconomic class population as defined, males had higher mortality rates from cardiovascular diseases than females; this was particularly true for arteriosclerotic heart disease. When comparisons of mortality were made by air pollution exposure for each sex, a regular pattern of association appeared for females but not for males. Cardiovascular mortality rates were higher among nonwhites than among whites of the same socioeconomic class, except for arteriosclerotic heart disease. This was generally true at all pollution levels. Mortality for cardiovascular disease increased regularly with age except for rheumatic heart disease which peaked at 65 to 74 years. When analysis was made by air pollution exposure, the greater proportional difference tended to occur in those under age 45 and the smallest difference in those 65 to 74 years. This analysis points to the need for additional studies designed to control such factors as stress, smoking, diet, occupation, and the like. (Authors' Abs.)

563
Amdur, M. O.
RESPIRATORY ABSORPTION DATA AND SO_2 DOSE-RESPONSE CURVES. Arch. Environ. Health, v. 12: 729-732, 1966.

Data published by Strandberg on the decreased upper respiratory absorption in rabbits of sulfur dioxide with decreasing air concentrations was applied to the dose-response curve using the increase in pulmonary flow-resistance in guinea pigs as the response. This calculated "lung" dose-response curve is a straight line over a range of 0.16-835 ppm air concentrations of sulfur dioxide. Strandberg's data are also used to explain the fact that the presence of a tracheal cannula does not lead to a greater response at low concentrations, whereas at high concentrations the response of the cannulated animals is greater than that of the animals breathing normally. The values obtained experimentally using animals with tracheal cannulas and the calculated "lung" dose-response curve appear to agree. (Author's Abs.)

564
Amdur, M. O.
THE RESPIRATORY RESPONSE OF GUINEA PIGS TO HISTAMINE AEROSOL. Arch. Environ. Health, v. 13: 29-37, 1966.

The effect of histamine aerosols on the respiration of guinea pigs was measured. The response, which was graded with the level of histamine, consisted of an increase in pulmonary flow resistance, a decrease in compliance, tidal volume, and minute volume. The effect on respiratory frequency depended on both the concentration and the duration of exposure. Lower concentrations tended to increase the frequency while higher concentrations produced an initial increase followed by a decrease. The changes in respiration could be quite major and yet were very quickly reversed when the exposure terminated. The overall effect on respiration was qualitatively different from that observed in response to irritants such as sulfur dioxide, acetic acid, formaldehyde, or formic acid. The response to ozone is similar to that of low levels of histamine as is the response of animals with acute hypersensitivity when challenged with an aerosol of the protein to which they are sensitive. (Author's Abs.)

565
Amdur, M. O., and D. A. Cresasia.
THE IRRITANT POTENCY OF M-TERPHENYL OF DIFFERENT PARTICLE SIZES. Amer. Indus. Hyg. Assoc. Jour., v. 27: 349-352, Aug. 1966.

The effect of homogeneous aerosols of m-terphenyl of 0.30, 0.65, 1.0, and 2.0 microns diameter on pulmonary-flow resistance of unanesthetized guinea pigs was studied. At equal mass concentration the irritant potency increased as the particle size decreased and the number of particles increased. A small increase in mass concentration for the smaller particles produced a greater increment in response than occurred when the large particles were used. The results were in agreement with earlier work on aerosols of zinc ammonium sulfate (Authors' Abs.)

566
Amdur, M. O. and D. Underhill.
THE EFFECT OF VARIOUS AEROSOLS ON THE RESPONSE OF GUINEA PIGS TO SULFUR DIOXIDE. Arch. Environ. Health, v. 16: 460-469, Apr. 1968.

The effects of various soluble and insoluble aerosols on the respiratory response of guinea pigs to sulfur dioxide have been studied. The aerosols discussed are sodium, potassium, and manganous chlorides, ammonium thiocyanate, ferrous sulfate, sodium orthovanadate, activated and spectrographic carbon, manganese dioxide, iron oxide fume, open hearth dust, fly ash, and triphenyl phosphate. All these aerosols when given alone produced no alteration in pulmonary flow resistance and more of them would be classed as pulmonary irritants. Ferric sulfate, however, was irritant. In ability to potentiate the response to sulfur dioxide, sodium chloride, potassium chloride, and ammonium thiocyanate ranked in that order. Soluble salts of manganese, ferrous iron, and vanadium, known to catalyze the oxidation of sulfur dioxide to sulfuric acid, potentiated the response to sulfur dioxide. This potentiation occurred more rapidly and at much lower concentrations of aerosol than with sodium chloride. The insoluble aerosols used were completely ineffective in potentiating the response to sulfur dioxide. Detailed post-exposure data obtained with sodium chloride as the aerosol suggest that the biological response results from the formation of an irritant aerosol. It appears from the data at hand that both solubility of sulfur dioxide in a droplet and oxidation to sulfuric acid play a major role in the observed potentiation of the response to sulfur dioxide by certain aerosols. The well-known disasters of the Meuse Valley, Donora, and London all have in common three factors: cold temperatures (which would increase the solubility of irritant gases in liquid), fog (which would provide droplets), temperature inversion (which would produce a stagnant air mass with increased concentration of all pollutants and time for chemical reactions). No laboratory experiments done anywhere will "prove" one way or another the "cause" of these episodes. The experiments presented here do not indicate that the key to the role of sulfur dioxide in air pollution toxicology lies not in the gas itself but in its atmospheric chemistry. (Authors' Abs., Modified)

567

Bachman, C. H., R. D. McDonald and P. J. Lorenz.
SOME EFFECTS OF AIR IONS ON THE ACTIVITY OF RATS.
Internat. Jour. Biometeorol., v. 10: 39-46, July 1966.

The data compiled from investigations on the effects of ionized air on living systems are inconsistent and often contradictory. In an attempt to see if the reported effects might be contradictory because they are dose specific, an empirical dose response curve is ascertained. The details and results of a study conducted to determine the effects of measured concentrations of ionized air upon the gross motor activity of rats are presented.

568

Bair, W. J. and J. V. Dilley.
PULMONARY CLEARANCE OF $^{59}Fe_2O_3$ AND $^{51}Cr_2O_3$ IN RATS AND DOGS EXPOSED TO CIGARETTE SMOKE.
In: Inhaled Particles and Vapours II, Ed. by C. N. Davies.
London, Pergamon Press, 1967, p. 251-271. (Proc. Internat. Symposium, Cambridge, England, Sept. 28-Oct. 1, 1965)

The inhibitory effects of cigarette smoke on tracheal ciliary activity have been reported by several authors. Because of the possible consequence of this effect on the toxicity of inhaled particles, preliminary studies were undertaken to determine whether cigarette smoke altered the clearance of particles from the lung. Acute exposures of rats to cigarette smoke did not influence the clearance of $^{59}Fe_2O_3$ or $^{51}Cr_2O_3$ particles from the lung. The possible effects of chronic cigarette smoking were examined in beagle dogs exposed to cigarette smoke of 20 cigarettes per day. Deposition of inhaled insoluble particles was tested periodically by exposing the dogs to aerosols by $^{59}Fe_2O_3$ or $^{51}Cr_2O_3$. Subsequently pulmonary clearance was measured by whole-body counting and body scanning techniques. No effects were seen in dogs exposed to cigarette smoke five days per week for over a year. (APTIC Abs.)

569
Bair, W. J. and J. F. Park.
COMPARATIVE DISPOSITION OF FOUR TYPES OF PLUTONIUM DIOXIDES INHALED BY DOGS. Battelle Memorial Inst., Richland, Wash., 1966, 33p. (BNWL-SA-633)

Groups of 3 dogs were given single inhalation exposures to dry aerosols of 1 of 4 different PuO_2 types to compare retention, translocation, and rates of excretion. Two of the PuO_2 types were prepared by calcining the oxalate at 350° and at about 1000°. Two others were produced by ignition of the stabilized delta metal at 450° and by slow oxidation of the pure metal at 123°. The lung retention half-time of the oxalate calcined at 350° was about one year, half that of the other oxides. This was due to greater accumulation of Pu in the bronchial lymph nodes rather than greater clearance via the mucus-ciliary pathway or a relatively high rate of soly. The metal oxidized at 450° was cleared via the mucus-ciliary route to a lesser extent than the other oxides. This same oxide also showed a selective loss of Am^{241}, relative to Pu^{239}, in lung and bronchial lymph node tissue which was not evidenced by the other oxides. The oxalate calcined at 1000° showed the least translocation to tissues outside the respiratory tract. These results indicate that the physiochemical state of inhaled PuO_2 influences its disposition in the body. (Chem. Abs.)

570
Bair, W. J., J. F. Park, and W. J. Clarke
LONG-TERM STUDY OF INHALED PLUTONIUM IN DOGS. Battelle Memorial Inst., Richland, Wash., Technical Report, Sept. 1, 1959- Apr. 30, 1965. Mar. 1966, 62p. (Report No. AFWL 65-214) AD 631690.

To determine the long-term translocation and biological effects of inhaled Pu, 40 beagle dogs were given a single 10-30 min exposure to $Pu^{239}O_2$ aerosols. Thirteen dogs died or were sacrified when clinical signs indicated death was imminent 29-66 months postexposure. The body burdens at death ranged from 0.5 to 3 μc with 40-75% of the body burden in the lungs, and 20-

50% in the bronchial and mediastinal lymph nodes. The liver contained 2-21% and the skeleton 1-7%. Cardiopulmonary insufficiency and lymphopenia were primary clinical signs. Pathology in the lungs consisted of severe fibrosis followed by alveolar cell hyperplasia, and bronchiolar and squamous types of metaplasia. Seven of the 13 animals showed bronchioloalveolar carcinomas, an incidence of 18% as compared to a reported canine primary lung-tumor incidence of 0. 2%. The bronchial lymph nodes were composed of dense sclerotic connective tissue devoid of any lymphoid element. Metastases of the pulmonary tumor to the bronchial lymph nodes were seen in 3 animals. Twenty-three dogs with body burdens of 0. 3-1 μc survived 4 to 6 years after exposure. (Chem. Abs.)

571
Bils, R. F.
ULTRASTRUCTURAL ALTERATIONS OF ALVEOLAR TISSUE OF MICE. I. DUE TO HEAVY LOS ANGELES SMOG. Arch Environ. Health, v. 12: 689-697, June 1966.

In the alveolar tissue taken 24 hrs after a smog peak, cytoplasmic fragments and proteinaceous material were seen in many alveoli. Some degree of swelling of the epithelium and endothelium was apparent. (Public Health Eng. Abs.)

572
Bils, R. F.
ULTRASTRUCTURAL EFFECTS OF AIR POLLUTION ON LUNG CELLS. Jour. Air Poll. Control Assoc., v. 18: 313-314, May 1968.

The lungs of exposed mice taken during 2- to 3-hrs heavy smog periods (over 0. 4 ppm total oxidants) showed various degrees of cytoplasmic damage in the alveolar epithelial cells. The extent of damage was markedly age-dependent. Alveolar wall cells taken during heavy smog from 5-month-old animals contained slightly more lamellar inclusion bodies than corresponding animals kept in clean air. The cytoplasm of alveolar cells of 9-month-old animals sacrificed during heavy smog was severely disorganized; however, animals of this age showed a marked recovery 14 hrs following the smog peak. In a group of older mice (21 months), similar cytoplasmic damage was obvious, and those sacrificed 24 hrs after the heavy smog peak showed even more cellular disruption, suggesting irreversible damage in the older animals. The effect of synthetic photochemical smog showed a pattern of ultrastructural alterations similar to that of the heavy natural smog. Some permanent changes occurred in alveolar cells of 15-month-old mice. Partial recovery of lining cells took place, but few wall cells and phagocytes remained. If older lung tissue has relatively fewer wall cells as is indicated, recovery is decreased to the point of permanent damage. Coupled with extensive disruption of lining membranes, exposures of this nature may well cause the death of older animals. (Author's Abs.)

573

Bils, R. F., and J. C. Romanovsky.
ULTRASTRUCTURAL ALTERATIONS OF ALVEOLAR TISSUE OF MICE: II. SYNTHETIC PHOTOCHEMICAL SMOG. Arch. Environ. Health, v. 14: 844-858, 1967.

Male A-strain mice were exposed for 3 hr to previously irradiated atmospheres which initially contained propylene, nitric oxide, carbon monoxide, and water vapor to simulate the oxidant concentration produced during a heavy smog peak. The lungs of these treated mice showed a pattern of ultrastructural alterations of alveolar tissue similar to that of tissues in heavy natural smog. Wall cell lamellar bodies generally increased in size and number in exposed 8-month-old mice, but only temporarily. Delaying death only 12 hr allowed the lungs to return to normal. Some permanent changes seemed to occur in exposed respiratory tissue of 15-month-old mice. Reasonably good recovery of smog-disrupted alveolar and capillary lining cells took place, but few wall cells remained. More extensive disorganization of wall cell cytoplasm and disruption of lining membranes occurred when the 20-month-old mice breathed the synthetic smog and delayed death allowed further damage and revealed cell debris in the alveoli. Since the synthetic smog produces cytological effects similar to the heavy Los Angeles smog, it may prove to be a useful tool in further studies concerning the effects of photochemical smog on biological systems. (Authors' Abs.)

574

Buckley, R. D. and O. J. Balchum.
EFFECTS OF NITROGEN DIOXIDE ON LACTIC DEHYDROGENASE ISOZYMES. Arch. Environ. Health, v. 14: 424-428, Mar. 1967.

Lactic dehydrogenase isozyme patterns were examined in guinea pigs after 26-, 33-, and 40-days' continuous exposure to 15 ppm nitrogen dioxide. Isozymes were separated from lung, liver, and kidney tissue homogenates from exposed and unexposed animals by disk electrophoresis. Gel samples were incubated with NAD and lactate, and nitro-BT tetrazolium was employed as coupling agent. Relative distributions of the isozyme was determined by densitometry. Inhalation of nitrogen dioxide resulted in a decrease in the relative amounts of the fast-moving (aerobic) isozyme and an increase in the slow-moving (anaerobic) isozyme in lung. Isozyme patterns in liver and kidney were not significantly altered following any of the exposure periods. (Authors' Abs.)

575
Buckley, R. D. and O. J. Balchum.
ENZYME ALTERATIONS FOLLOWING NITROGEN DIOXIDE EXPOSURE. Arch. Environ. Health, v. 14: 687-692, May 1967.

Oxygen consumption (QO_2) and aldolase and lactic dehydrogenase (LDH) determinations were performed on guinea pig lung, liver, kidney, and spleen tissue homogenates following continuous exposure to 10 ppm nitrogen dioxide (NO_2) for varying periods of time. Inhalation of NO_2 resulted in increased QO_2 values not only in the lung but also in kidney tissue for each exposure period. The QO_2 in the liver and spleen homogenates were significantly elevated following 32 days' exposure but did not show a consistent increase after other exposure periods. Aldolase activity was significantly elevated in lung following 12 days' exposure and in lung and liver following 32 days' exposure to NO_2. Significant decreases in aldolase activity were noted in lung, kidney, and spleen after 26 days' exposure. The LDH values were increased in lung, liver, and kidney as a result of inhalation of NO_2. The possibility of the presence of circulating substances resulting from the interaction of NO_2 and lung or blood tissue or from a general physiological 'stress' reaction or both were suggested as possible explanations for enzyme and QO_2 alterations observed in kidney, liver, and spleen. The possible effects of respiratory infection (L-form of Pseudomonas aeruginosa) on the metabolism of lung tissue was also discussed. (Authors' Abs.)

576
Campbell, K. I., G. L. Clarke, L. O. Emik and others.
THE ATMOSPHERIC CONTAMINANT PEROXYACETYL NITRATE. ACUTE INHALATION TOXICITY IN MICE. Arch. Environ. Health, v. 15: 739-744, Dec. 1967.

Acute lethal toxicity of peroxyacetyl nitrate (PAN) expressed as median lethal concentration, or LC_{50}, was estimated at 106 ppm. Male A-strain mice were exposed for 2 hours and mortality was observed for 28 days. The potency of PAN is apparently much greater than that of sulfur dioxide, similar to that of nitrogen dioxide, and less than that of ozone. Median lethal exposures characteristically produced a delayed mortality pattern, most deaths occurring in the second and third week following exposure. Lethal toxicity was greater in older mice than in young mice, and at higher than at lower temperatures, but was not influenced appreciably by relative humidity. (APTIC Abs.)

577

Coffin, D. L. and E. J. Blommer.
ACUTE TOXICITY OF IRRADIATED AUTO EXHAUST.
Arch. Environ. Health, v. 15: 36-38, July 1967.

A description of the experiments conducted on mice to determine the effect of light-irradiated automobile exhaust is presented. It was concluded that the light-irradiated automobile exhaust enhances mortality to infectious pneumonia. At levels well below peak concentration in heavily polluted air (22 and 0.14 pom) carbon monoxide and oxidant, respectively, in laboratory-synthesized photochemical smog mortality to streptococcal pneumonia was enhanced.

578

Dalhamn, T.
INHIBITION OF THE CILIOSTATIC EFFECT OF CIGARET SMOKE BY OXOLAMINE CITRATE. Amer. Rev. Respiratory Diseases, v. 94: 799-800, 1966.

When oxolamine citrate (I) (100 mg /kg) was given orally to 5 cats prior to their exposure to cigaret smoke, the number of cigaret puffs required to produce ciliostasis was ~ 2-fold greater than that in unpremedicated cats. When I was given after ciliary activity had been arrested by cigaret smoke, some recovery of ciliary function was found in 4 of the 5 cats. All 5 cats treated with I showed distinctly increased secretion of mucus, whereas the trachea remained dry in 4 of the 5 control animals, indicating that the true cause of changes in ciliary beat frequency is alteration of the tracheal secretion. These results suggest that cigaret smoke inhibits tracheal secretion or alters its viscosity, while I stimulates the production of mucus. (Chem. Abs.)

579

Dalhamn, T., B. Holma, and L. Tomenius.
IN VITRO STUDIES OF THE CILIOTOXIC ACTION OF ETHANOL VAPOR IN RELATION TO ITS CONCENTRATION IN TRACHEAL TISSUE. Acta Pharmacologica et Toxicologica (Köbenhavn), v, 25: 272-280, 1967.

The concentration of EtOH in rabbit tracheal tissue required to arrest tracheal ciliary activity in vitro was ~4% regardless of size and age of specimen, the atmospheric concentration of EtOH vapor, and the duration of exposure preceding ciliostasis. The rate of absorption of EtOH vapor was dependent on the size of the specimen; absorption was more rapid in smaller specimens. The possibility that cessation of ciliary movement was masked by coagulated mucoprotein was eliminated by the absence of discernible changes in the mucus. After ciliostasis, the blood vessels were still clearly visible beneath the secretion. (Chem. Abs.)

580

Dalhamn, T. and L. Reid.
CILIARY ACTIVITY AND HISTOLOGIC OBSERVATIONS IN THE TRACHEA AFTER EXPOSURE TO AMMONIA AND CARBON PARTICLES. In: Inhaled Particles and Vapours, II. Ed. by C. N. Davies. London, Pergamon Press, 1967, p. 299-306. (Proc. Internat. Symposium, Cambridge (England), Sept. 28 - Oct. 1, 1965)

A study was made of the effects of the maximum allowable concentration of amounts (100 ppm) on ciliary activity in the trachea and the histologic appearance of the tracheal mucosa, and of the possible synergism between that ammonia concentration and admixed carbon particles. (APTIC Abs.)

581

Dixon, J. R., W. D. Wagner, T. D. Martin and others.
METAL SHIFTS AS EARLY INDICATORS OF RESPONSE FROM LOW-GRADE PULMONARY IRRITATION. Toxicol. and Appl. Pharmacol., v. 9: 225-233, 1966.

In preliminary studies designed to determine whether the metal content of critical organ sites is altered following brief exposure to a pulmonary irritant, it was found that the copper content in the lungs of rats exposed to ozone at 3 ppm for 4 hr was consistently greater than that in the lungs of control rats. In the exposed lungs, zinc was also significantly increased at 20 hr after the exposure. Molybdenum showed less consistent changes in the exposed lungs. Depending upon the magnitude of the metal shifts in the lung, metal shifts occurred or did not occur in the liver. The glutathione content of the lungs of rats exposed to ozone under similar conditions was increased at 3 hr post-exposure, and then decreased to normal values at 20 hr post-exposure. These findings suggest that copper may act as a catalyst for the oxidation of glutathione by ozone during the lung injury process. If subsequent studies confirm the preliminary findings of this study, metal shifts in organs may prove to be early indicators of the injury process from pulmonary irritants, and lead to new insight into the mechanism of edemagenesis. (Authors' Abs.)

582

Easton, R. E. and S. D. Murphy.
EXPERIMENTAL OZONE PREEXPOSURE AND HISTAMINE. EFFECT ON THE ACUTE TOXICITY AND RESPIRATORY FUNCTION EFFECTS OF HISTAMINE IN GUINEA PIGS.
Arch. Environ. Health, v. 15: 160-166, Aug. 1967. (Presented in part at 5th Annual Meeting, Soc. of Toxicol., Williamsburg, Va., Mar. 8, 1966)

In a preliminary study the action of various drugs on the respiratory effects of air contaminants in guinea pigs showed that ozone-exposed guinea pigs were more susceptible to the toxic action of histamine than animals which had not been exposed to the gas. The data presented in this report confirm and extend that preliminary observation. Random-bred male guinea pigs (250 to 400 gm) were used. The animals were housed in air-conditioned laboratories and were fed a standard guinea pig diet supplemented with greens twice weekly. For the mortality studies the animals were individually caged and placed in six cu ft stainless steel exposure chambers. Ozone was produced by metering filtered, dried air or oxygen (for high concentration experiments) through a dielectric ozone generator. Histamine dihydrochloride was administered subcutaneously in saline (0.9% sodium chloride) solution. The histamine concentrations of the solutions were adjusted so that an injection volume of 0.5 ml/kg contained the desired dose. For administration as an aerosol, a 0.5% aqueous solution of histamine dihydrochloride was aerosolized in a generator operating under 15 lb/sq in pressure. The plethysmograph-intrapleural catheter technique of Amdur and Mead was used for measuring the effects of ozone and histamine on the pulmonary flow resistance (FR), lung compliance (LC), respiratory frequency (f), and tidal volume (TV) of guinea pigs. For measurements of lung water, the

and extend that preliminary observation. Random-bred male

lungs were dissected just above the tracheal bifurcation, trimmed, gently blotted, weighed, and dried at 130°C ± 5°C for 24 hrs, and weighed again. Analyses of the the histamine content of lungs were performed by the fluorometric method described by Shore et al. The results are expressed as micrograms of histamine base per gram of lung. Increased susceptibility to histamine ws was detectable for as long as 12 hrs after the end of a two-hr exposure to 5 ppm of ozone. The effect of injected histamine on the respiratory mechanics of guinea pigs was greater in ozone-preexposed than in control animals at a time when residual functional effects of ozone were no longer detectable. (APTIC Abs.)

583
Ehrlich, R.
EFFECT OF NITROGEN DIOXIDE ON RESISTANCE TO RESPIRATORY INFECTION. Bacteriol. Rev. v. 30: 604-614, Sept. 1966.

In laboratory animals acute and chronic exposures to nitrogen dioxide reduce resistance to infection produced by respiratory challenge with airborne Klebsiella pneumoniae. (Public Health Eng. Abs.)

584
Epstein, S. S.
CARCINOGENICITY OF ORGANIC EXTRACTS OF ATMOSPHERIC POLLUTANTS. Jour. Air Poll. Control Assoc., v. 17: 728-729, Nov. 1967. (Presented at: 60th Annual Meeting Air Poll. Control Assoc., Cleveland, Ohio, June 11-16, 1967. Paper No. 67-81)

The carcinogenicity of atmospheric pollutants can be demonstrated by chemical or biological methods. Chemical methods depend on the identification and measurement of known carcinogens, such as benzo[a]pyrene (BaP), in extracts of atmpsheric pollutants. The value of chemical approaches is limited as various pollutant fractions, e.g., the oxyneutral or basic, contain undefined carcinogens; additionally, chemical techniques cannot predict the probability of in vivo interactions between various pollutant components or of enhanced carcinogenicity due to promoting agents such as phenols. Biological methods for demonstrating carcinogenicity are generally based on repeated skin painting or subcutaneous injection of pollutant extracts in mice. Marked variation in the carcinogenicity of organic extracts from various urban sites, incidentally with low activity in Los Angeles, has been noted. In addition to PaP, the role of other carcinogens in crude organic extracts is now generally accepted. Evidence for this includes, tumor production by PaP-free pollutants such as aliphatic aerosols of a synthetic smog and by aliphatic and oxygenated fractions of organic extracts, lack of parallelism between carcinogenicity of organic extracts and their BaP concentrations, and finally by the pattern and multiplicity of tumors developing following injection of pollutant extracts in infant mice. Recent indirect evidence, based on the photodynamic assay has incriminated di-alkylated benz[c]acridines and 7H-benz[de]-anthracene-7-one as the probable major polycyclic carcinogens in basic and oxygenated fractions, respectively. Definitive identification of organic carcinogens in atmospheric pollutants, _inter alia,_ depends on the availability of adequate amounts of organic extracts, their fractions and sub-fractions, approximately 10 kg of atmospheric particulates are required to produce a 10 g sample of the basic fraction, and in correlated chemical and biological investigations. (APTIC Abs.)

585

Epstein, S. S., S. Joshi, J. Andrea and others.
SYNERGISTIC TOXICITY AND CARCINOGENICITY OF FREONS AND PIPERONYL BUTOXIDE. Nature, v. 214: 526-528, 1967.

A combination of Freon 11 (CCl_3F), Freon 112 (CCl_2FCCl_2F) or Freon 113 (CCl_2FCClF_2) at 10% (v/v) with 5% (v/v) piperonyl butoxide administered subcutaneous at 0.1 ml into 1-7 day-old-mice or 0.2 ml into 14-21 day-old mice, caused 46-55% mortality before weaning at 1 month compared with 2-15% mortality in the groups given solvent, tricaprylin, or the test compounds separately. After weaning, mortality was low in females and high in males, and toxicity in both sexes was accompanied by a 10-20% increase in body weight over that in controls. Combined treatments increased the incidence of hepatomata by ~ 20% in male mice; the incidence of malignant lymphomata was low. Piperonyl butoxide may alter a presumed in vivo dehalogenation of Freons. (Chem. Abs.)

586

Frank, N. R., R. E. Yoder, F. E. Speizer and others.
THE DIFFUSION OF $^{35}SO_2$ FROM TISSUE FLUIDS INTO THE LUNG FOLLOWING EXPOSURE OF DOGS TO $^{35}SO_2$. Health Phys., v. 13: 31-38, 1967.

Surgically isolated airways of head and neck in anesthetized paralyzed dogs were exposed to 22 ± 2 ppm of $^{35}SO_2$, delivered at 3.5 1/min for 30-60 min. Lungs were ventilated with ambient air by a positive displacement respiratory pump. In 10 to 12 measurements, over 95% of $^{35}SO_2$ administered was absorbed by the mucosa. In all animals $^{35}SO_2$ was present in 1 or more expired gas samples collected either at the carina or from a bronchus; this expired $^{35}SO_2$ could not have entered the lower airways in inspired air and its presence provided evidence that the lungs were releasing the gas in expiration, presumably from pulmonary capillaries. Sulfur-35 was present in the blood and urine within minutes of the onset of exposure to $^{35}SO_2$. (Biol. Abs.)

587

Goldring, I. P., P. Cooper, I. M. Ratner, and others. PULMONARY EFFECTS OF SULFUR DIOXIDE EXPOSURE IN THE SYRIAN HAMSTER. I. COMBINED WITH VIRAL RESPIRATORY DISEASE. Arch Environ. Health, v. 15: 167-176, Aug. 1967.

This investigation was designed to study the sequential histopathological changes which might occur in the trachea and lungs of animals subjected to daily exposures of SO_2, and to determine any additive effect in the histopathology which might develop in animals previously challenged with a respiratory virus. It was hoped that such a study might furnish some clues to the respiratory problems experienced by humans with respiratory ailments exposed to air pollution episodes. Syrian hamsters were subjected to long-term chronic exposures of sulfur dioxide (SO_2) at high concentrations (650 ppm). Control animals were exposed to a fashion to filtered room air. Groups of animals were co-challenged with a viral respiratory infection either at the beginning of their exposure to SO_2 or after 75 daily exposures to SO_2. At predetermined times animals from all groups were killed and histopathological studies of their lungs and trachea were made. The results indicate that Syrian hamsters can tolerate daily exposure to high concentrations of SO_2 with no marked effects. The SO_2-exposed animals did not gain weight at the same rate as control animals. Pathological changes in the lungs were minimal and consisted in loss of cilia in focal areas of tracheal epithelium. The lungsof SO_2-exposed animals exhibited a variety of minor irritative phenomena. Some congestion was seen as well as some interstitial edema. Areas of atelectasis were often present. Slight focal emphysema was common and areas of alveolar bronchiolization were found. Only two animals out of 78 chronically exposed to SO_2 were seen with marked proliferation of the bronchial lining epithelium. There was no additive histopathology in animals doubly challenged with a virus infection and chronic exposure to SO_2. (APTIC Abs.)

588

Goldring, I. P., L. Greenburg, and I. M. Ratner.
ON THE PRODUCTION OF EMPHYSEMA IN SYRIAN HAMSTERS BY AEROSOL INHALATION OF PAPAIN.
Arch. Environ. Health, v. 16: 59-60, Jan. 1968.

A simple method is described for the production of emphysema in the Syrian hamster by a single exposure to an aerosol of papain. All animals which were exposed developed extensive emphysema in all lobes of the lungs. The lesions are panacinar and similar to those seen in the human lung. (Authors' Abs.)

589

Gregory, A. R., L. A. Ripperton, and B. Miller.
EFFECT OF NEONATAL THYMECTOMY ON THE DEVELOPMENT OF OZONE TOLERANCE IN MICE. Amer. Indus. Hyg. Assoc. Jour., v. 28: 278-282. May-June, 1967. (Presented at: Amer. Indus. Hyg. Conf., Houston, Texas, May 3-7, 1967)

Male white Swiss mice, thymectomized at birth, were unable to develop tolerance to ozone when pre-exposed to sublethal concentrations of 0.3 and 5.0 ppm of ozone for one hour. On the other hand, tolerance was readily induced in sham-operated animals. Thus the thymus appears to be necessary during maturation for the development of tolerance to ozone. No statistical difference in mortality was shown between mice pre-exposed to 0.1 ppm of ozone and those not so pre-exposed, despite the fact that a larger number of pre-exposed animals survived. (APTIC Abs.)

590

Hackney, J. D., R. F. Bils, M. J. Evans and others.
FUNCTIONAL AND MORPHOLOGICAL RESPONSE OF IN VITRO LUNG AND MYOCARDIAL TEST OBJECTS TO EXPERIMENTAL GAS ENVIRONMENTS. Jour. Air Poll. Control Assoc., v. 18: 9-11, Jan. 1968.

Innovations in the use of lung and myocardial tissue in vitro have permitted continuous morphological observation of cells treated with a controlled gaseous environment. Rabbit lungs excised intact with trachea were injected with warm (37°) nutrient agar via the trachea until portions of the lungs were fully inflated. Lungs from approximately 2-yr old rabbits were filled with agar and the prepared Rose chambers were exposed to different concentrations of $NaNO_2$. Randomly selected chambers and specimens were used for ultrastructural studies and were fixed in the Veronal-acetate buffered OsO_4 and embedded in the plastic. The $NaNO_2$ exposed group showed definite abnormalities like bleeding of the surface of the epithelial cells, vesicular formation, and disruption of alveolar lining cells as compared with the controls. The beating rate of myocardial cells in tissue culture was found to be an objective and convenient end point for testing the characteristics of the gas exposure system. Exposure to N 98% and CO_2 2% resulted in rapid cessation of beating cells, restored to normal on exposure to O 98% and CO_2 2% (1 min). The stability of bubbles expressed from bits of lung in flask culture has been studied as an index of the presence of surfactant in these cultures. Bubble stability persisted for a longer time in tissue treated with 100% N, NaCN (10^{-3}M), or acetylcholine, as compared to control tissue. A comparison of the response of cells in the gas phase within the same chamber suggested that this system can serve as a model for evaluating the effect of an increasing diffusion barrier, and the effect of other and toxic environments might be successfully studied utilizing these systems. (Chem. Abs., Modified)

591

Hueter, F. G., G. L. Contner, K. A. Busch and others. BIOLOGICAL EFFECTS OF ATMOSPHERES CONTAMINATED BY AUTO EXHAUST. Arch. Environ. Health, v. 12: 553-560, 1966.

Irradiated auto exhaust increases the susceptibility to pulmonary infection and chronic disease during the latter half of the mouse's lifetime and markedly decreases mouse fertility and the survival rate of infant mice. Both raw and irradiated auto exhaust cause a stress and adaptation response in mice (measured via spontaneous activity), increase bone lead concentrations, and increase the amount of nonfunctional or abnormal lung tissue. No experimental atmospheric effects were observed concerning: mortality; histopathology; growth-bodyweight; immunology; hematology restricted to erythrocyte count, erythrocyte cell size distribution, hematocrit or hemoglobin concentration; blood O_2 and CO_2 values; oxygen consumption; or pulmonary function in relation to permanent impairment. (Biol. Abs., Modified)

592
Kistler, G. S., P. R. B. Caldwell, and E. R. Weibel.
DEVELOPMENT OF FINE STRUCTURAL DAMAGE TO ALVEOLAR AND CAPILLARY LINING CELLS IN OXYGEN-POISONED RAT LUNGS. Jour. Cell Biol., v. 32: 605-628, 1967.

Rats were exposed to 98.5% oxygen at 765 torr for 6-72 hrs. The pulmonary changes were investigated by electron microscopy and by morphometric methods. A progressive thickening of the air-blood barrier, from the normal 1.5 to 3 μ after 3 days, was due primarily to enlargement of the interstitial space by accumulation of edema which was replaced secondarily by cells and fibrin. This was accompanied by destruction of about 50% of the capillaries. Morphometric data allowed an estimate of the degree of impairment of lung function. The primary cellular damage was located in endothelial cells which underwent cytoplasmic changes and, finally, fragmentation. In contrast, the damage to the epithelial lining of alveoli was relatively scarce compared to the extensive endothelial changes. This pertained even to severely damaged lungs with 65% of the alveoli obliterated by a heterogeneous exudate. Possible causes for this apparently different reaction of epithelium (the first target cell) and endothelium to toxic oxygen effects are discussed. (Authors' Abs.)

593
Kohtiao, A., I. Resnick, J. Newton and others.
TEMPERATURE RISE AND PHOTOCOAGULATION OF RABBIT RETINAS EXPOSED TO THE CW[CONTINUOUS WAVE] LASER. Amer. Jour. Opthalmol., v. 62: 524-528, 1966.

Retinal photocoagulations were produced on rabbit retinas exposed to a 25-mw CW helium neon-gas laser beam. The lesions are to be expected on the basis of the flux density calculations. Temperature measurements at the lesion site and histologic studies were made. A temperature rise of 7.8°C has been obtained at the center of the lesion after 2.5 secs of exposure. With the future development of more power, the cw lasers offer promise in the field of retinal photocoagulation. (Authors' Abs.)

594
Krueger, A. P., P. C. Andriese and S. Kotaka.
THE EFFECTS OF INHALING NON-IONIZED OR POSITIVELY IONIZED AIR CONTAINING 2-4% CO, ON THE BLOOD LEVELS OF 5-HYDROXYTRYPTAMINE IN MICE. Internat. Jour. Biometeorol., v. 10: 17-27, July 1966.

Drastic deviation from the air ion balance normally prevailing in nature may be of significance in determining the habitability of closed quarters. A prime example should be space vehicles and submarines, indeed Schaefer (1959) observed increased numbers of air ions in the atmosphere of German submarines of the type employed in World War II. Experiments are conducted in an atmosphere simulating the conditions existing aboard submarines during long underwater patrols and containing more than the normal concentration of CO_2 found in outside air. Mice were maintained in atmospheres of 2% or 4% CO_2 and in identical atmospheres subjected to positive ionization. The results of the experiments and the evaluation of the reaction in terms of the changes produced in 5-hydroxytrystamine (serotonin) blood levels are presented.

595
Lee, S. D., and R. M. Danner.
BIOLOGICAL EFFECTS OF SO_2 EXPOSURES ON GUINEA PIGS. Arch. Environ. Health, v. 12: 583-587, 1966.

Experiments were conducted to establish the minimum SO_2 exposure concentration that would consistently affect the respiration and biochemistry of guinea pigs. Sulfur dioxide exposures at concentrations above 19 ppm for 1 hr caused an increase in tidal volume and a decrease in respiration rate, with irregular effects on minute volume. Sulfur dioxide exposures at concentrations ranging from 7 to 17 ppm caused a general decrease in tidal volume and an increase in respiration rate. Hemoglobin concentrations increased after SO_2 exposure with all concentrations (7 to 310 ppm) tested. Control animals showed decreased hemoglobin concentrations following a comparable test period without SO_2 exposure. Blood inorganic sulfur concentrations increased after exposures to SO_2 concentrations above 19 ppm and exhibited irregular responses below 17 ppm of SO_2. Control animals showed decreased blood inorganic sulfur concentrations. (Authors' Abs.)

596
Lewis, T. R., F. G. Hueter, and K. A. Busch.
IRRADIATED AUTOMOBILE EXHAUST. (ITS EFFECTS ON THE REPRODUCTION OF MICE.) Arch. Environ. Health, v. 15: 26-35, July 1967.

This study attempts to define the relative importance of preexposure of each member of the sexual pair to irradiated auto exhaust, and exposure of the female partner and her litter, following removal of the male with regard to conception, fetal development, fecundity, and infant survival. There were 150 virgin female mice of the LAF_1 strain, preconditioned to either filtered air or irradiated automobile exhaust for 46 days, who were randomly paired with 150 similarly preconditioned males. All mice were 12 to 13 weeks of age at the time of mating and were caged individually during the preconditioning period. Males and females were paired randomly to form approximately equal numbers of sexual pairs (18 or 19) in each of eight treatment groups. The experiment was repeated with a new population of mice of the same strain 15 days after completion of the first investigation. The adverse effects of pre-conditioning male mice with irradiated auto exhaust on conception, implantation of fertilized ova, fecundity, and infant survival appear to be induced by a common mechanism. This is the first experiment the results of which imply mutational effects on mammalian cells by components or subsequent products of irradiated auto exhaust. An effect of the alteration of one environmental factor in this investigation, i. e. atmospheres to which the females were exposed, was evidenced by mild stress on litter sizes. Litters born in an atmosphere of irradiated auto exhaust showed a marked increase in mortality in both experiments, but the magnitude differed. (APTIC Abs.)

597

Lloyd, T. C., Jr.
INFLUENCES OF PO_2 [OXYGEN TENSION] AND pH ON RESTING AND ACTIVE TENSIONS OF PULMONARY ARTERIAL STRIPS. Jour. Appl. Physiol., v. 22: 1101-1109, 1967.

Helically cut strips of 4th- and 5th-order pulmonary arteries were obtained from dogs and rabbits and studied in a muscle bath. Isometric contractions of these strips were recorded. The effects on resting tensions and on the tensions following induction of contractions by several stimuli were observed during periods of O_2 deprivation and of variation of bath pH from 6.6 to 8.0. The stimuli for contractions included electrical current, serotonin, norepinephrine, angiotensin, acetylcholine, and potassium chloride. Neither hypoxia nor pH alteration changed resting tension. Hypoxia depressed the tensional responses to all stimuli, and acidification depressed responses to all stimuli except addition of norepinephrine to the bath solution. No evidence could be found that hypoxia either increased excitability or contractility or in itself caused arterial contraction. The ability to maintain the tensions of the arterial strips clearly depended on the presence of O_2. Hypoxic pulmonary vasoconstriction in vivo is therefore probably not a manifestation solely of changes of vascular muscle. The phenomenon of hypoxic pulmonary vasoconstriction also is probably not a manifestation of arterial contractions caused by hypoxic acidosis, since acidosis typically depressed strip tension. Experiments relating the contractile response of arterial strips to muscle cell membrane potential were presented and discussed. From these experiments it was suggested that tensional responsee to all stimuli used were functions of the membrane potential difference. (Author's Abs.)

598

Lutmer, R. F., K. A. Busch, and P. L. DeLong.
EFFECT OF NITRIC OXIDE, NITROGEN DIOXIDE, OR OZONE ON BLOOD CARBOXYHEMOGLOBIN CONCENTRATION DURING LOW-LEVEL CARBON MONOXIDE EXPOSURES. Atmos. Environ., v. 1: 45-48, Jan. 1967.

In 8 experiments, rats and mice were exposed for 7 hr to various atmospheres containing CO or CO plus NO, NO_2, or O_3. Blood CO values, expressed as percent carboxyhemoglobin, were determined for individual animals following the various exposures. Statistical analysis of the data revealed that blood carboxyhemoglobin levels are primarily dependent on the atmospheric CO concentration and are not significantly affected by the simultaneous atmospheric presence of NO, NO_2, or O_3. (Authors' Abs.)

599

Lutmer, R. F., K. A. Busch and R. G. Miller.
LEAD FROM AUTO EXHAUST: EFFECT ON MOUSE BONE LEAD CONCENTRATION. Atmos. Environ, v. 1: 585-589, July 1967.

Mice exposed for 15 months to low levels of non-irradiated auto exhaust in a cyclic diurnal pattern contained more lead in their bones than corresponding groups exposed to equal or slightly lower concentrations of irradiated auto exhaust even though the daily average atmospheric lead concentrations were about the same in both atmospheres. Bone lead concentrations in mice exposed to irradiated auto exhaust were not significantly higher than those in control air animals until the 24-hrs average atmospheric lead concentrations exceeded 9.6 $\mu gPb/m^3$, but mice exposed to as little as 2.6 $\mu gPb/m^3$ of non-irradiated exhaust had bone lead concentrations higher than the control mice. (Authors' Abs.)

600

McDonald, R. D., C. H. Bachman, and P. J. Lorenz.
SOME PHYSIOLOGICAL EFFECTS OF AIR ION TREATMENT WITHOUT ION INHALATION. Internat. Jour. Biometeor., v. 9: 141-147, 1965.

A companion paper described experiments in which only the nostrils of rats were exposed to ionized air. This paper gives results obtained from similar experiments, except that the bridge of the animal's nose was exposed to ions but inhalation of the ionized atmosphere was prevented. The heart rate was unaffected by negative air ion exposure, positive air ions caused depressed heart rate. Respiration rate was generally unaffected by ions although there was a possible final difference under negative air ion treatment. (Authors' Abs.)

601

Pansy, F. E., H. Basch, W. P. Jambor and others.
HAMYCIN: IN VITRO AND IN VIVO STUDIES. Antimicrobial Agents Chemotherapy, 1966, p. 399-404.

In an agar diffusion procedure, 50% horse serum greatly increased the zones of inhibition of *Candida albicans* and *Curvularia maculans* produced by hamycin and amphotericin B, but not those produced by nystatin. In 3 liquid media with 10% calf, rabbit, and horse sera, there was little or no effect on the minimal inhibitory concentrations of any of the 3 antibiotics. Administered to mice (orally for 5 days) infected i.p. with Trichomonas foetus, hamycin was inactive in doses equivalent to 44, 133, and 400 mg/kg day. At the 2 higher dosage levels, there was evidence of toxicity. A cream containing 0.5% hamycin applied topically for 10 days in a *T. foetus* intravaginal infection of guinea pigs was curative but highly irritating. At 0.1%, hamycin was nonirritating but was inactive. Administered orally in 3 doses to mice infected intravaginally with *C. albicans*, hamycin gave a median protective dose (PD_{50}) of 46. 2. mg/kg of body weight. In vitro, the same strain of *C albicans* as that used in vivo was 5-fold more susceptible to hamycin than to amphotericin B. (Chem. Abs.)

602

Rinehart, W. E.
THE EFFECT ON RATS OF SINGLE EXPOSURES TO CROTONALDEHYDE VAPOR. Amer. Indus. Hyg. Assoc., Jour., v. 28: 561-566, 1967.

Lethal concentrations of crotonaldehyde to rats were: 3200 ppm for 5 min, 1650 ppm for 10 min, 850 ppm for 15 min, 600 ppm 30 min, 400 ppm for 1 hr, and 100 ppm for 4 hrs. Above 1000 ppm a central nervous system effect occurred during exposure as well as postexposure pulmonary irradiation. With humans, odor is strong at 15 ppm, but there was no eye discomfort. Concentrations of 45 ppm were obnoxious and produced a burning sensation of the conjunctivae. With rats, exposure to concentration time levels of 2000 ppm -min caused definite pulmonary impairment (based on uptake rate of CO and ether) which if depressed below 40% of normal was not compatible with continued life. There was no effect from 10 to 580 ppm. Histological manifestations of pulmonary irritation in rats exposed to concentration time levels of 8,000 ppm -min were still evident 3 days postexposure. (Chem. Abs.)

603

Rounds, D. E., and R. S. Olson.
THE EFFECT OF INTENSE VISIBLE LIGHT ON CELLULAR RESPIRATION. Life Sci., v. 6: 359-366, 1967.

The O consumption of rat brain cells was determined while shining 1600 ft candles of light of various wavelengths through the cell suspensions. Light of 430-40 mμ and of 546 mμ caused a 10% increase in O consumption for approximately 20 min and subsequently caused an inhibition, which ultimately reached 50%. Light of 560-620 mμ caused inhibition only, while light of 577 mμ had little or no effect. (Chem. Abs.)

604

Saffiotti, U., F. Cefis, L. H. Kolb, and others
THE CONDITIONS OF EXPOSURE TO CARCINOGENS FOR LUNG CANCER INDUCTION. Jour. Air Poll. Control Assoc., v. 15: 23-25, 1965.

A method is described for the experimental induction of lung cancer. Syrian golden hamsters, receiving repeated intratracheal administrations of benzo[a]pyrene in particulate form carried by an inert dust, develop a high incidence of bronchogenic carcinoma. The conditions of exposure to the carcinogen, involving penetration and retention of carcinogen particles in lung tissues with the dust, are of prime importance in the determination of the results. Instillations of the same carcinogen in other media did not induce lung tumors. The relative importance of the identification of carcinogenic materials in air pollution and of the conditions of exposure in the origin of lung cancer is discussed. (Chem. Abs.)

605
Saffiotti, U., R. Montesano, A. R. Sellakumar, and others.
EXPERIMENTAL CANCER OF THE LUNG. INHIBITION BY VITAMIN A OF THE INDUCTION OF TRACHEOBRONCHIAL SQUAMOUS METAPLASIA AND SQUAMOUS CELL TUMORS.
Cancer, v. 20: 857-864, May 1967. (Presented at: 9th Internat. Congr., Tokyo, Oct. 1966).

The purpose of this investigation was to explore the mechanism controlling the initial metaplastic change in the response of the tracheobronchial mucosa to carcinogens using vitamin A as a tool to investigate the role of cellular differentiation in the pathogenesis of tumors derived from the bronchial mucosa. Two groups of Syrian golden hamsters, each containing 36 males and 36 females received 10 intratracheal installations of 3 mg of benzo(a)pyrene (BP) and 3 mg of hematite suspended in saline given once weekly. One group received stomach tube feedings of vitamin A parmitate (5 mg or 5, 000 IU in 0. 1 ml of corn oil) twice weekly for life beginning one week after the end of the BP treatment. In the group receiving no vitamin A, there were 13 cases of squamous tumors and 13 cases of squamous metaplasia in 53 animals at risk. In the group receiving vitamin A, one developed a microscopic squamous tumor in a bronchus and one developed a patch of squamous metaplasia in the trachea among 46 animals at risk. There was a marked reduction of forestomach papillomas among the vitamin A group. It is indicated that vitamin A administered following a carcinogenic exposure to the respiratory tract to benzo(a)pyrene can interfere with the induction of squamous metaplasia and squamous tumors in the tracheobronchial mucosa. (APTIC Abs.)

606
Soremark, R., and V. R. Hunt.
DISTRIBUTION OF POLONIUM-210 IN MICE FOLLOWING INHALATION OF POLONIUM-210-TAGGED TOBACCO SMOKE.
Arch. Environ. Health, v. 14: 585-588, Apr. 1967.

An attempt was made to observe the distribution pattern of ^{210}Po throughout the body of the mouse, after inhalation of tobacco smoke tagged with ^{210}Po, by the use of a whole-body autoradiographic method. Twelve adult mice were exposed to tobacco smoke containing ^{210}Po. The mice were killed at various times after the last smoking procedure. The survival periods were 15, 30, and 60 min, and 2, 8, and 24 hr. Two animals were killed after each survival period. All the animals were exposed to tobacco smoke to which extra polonium had not been added, in the smoking chamber for one hour every day for two weeks before the experimental exposure. The animals were killed by complete immersion in a mixture of acetone and liquid carbon dioxide (-75 C). The completely frozen mice were then mounted in a sledge microtome in a cold room (-12 C). Sections (20 μ thick) were taken through the entire animals, saggftal sections from one and frontal sections from the other mouse of the pair of animals from each survival period. The sections were kept on adhesive tape; after a period of 24 hours of freeze drying they were put in contact with dental occlusal film for two months of exposure. Several 10 μ-thick sections were taken of the lungs. These sections were used for microautoradiography on emulsions. The ^{210}Po used was 1 mc/0.1 ml in a 1 N HNO_3 solution. At various periods studied after the last exposure the ^{210}Po tagged smoke, the highest deposition of ^{210}Po was found in the respiratory tract, i.e., the nasal cavities, trachea, and bronchi, and in the lungs, as well as in the stomach. Although an attempt was made to clean the smoke from the fur with ether immediately after the inhalation period, it was likely that ^{210}Po remained on the fur and skin. (APTIC Abs.)

607

Swann, H. E., Jr. and O. J. Balchum.
BIOLOGICAL EFFECTS OF URBAN AIR POLLUTION. IV. EFFECTS OF ACUTE SMOG EPISODES ON RESPIRATION OF GUINEA PIGS. Arch. Environ. Health, v. 12: 698-704, June 1966.

When total expiratory flow resistances on days of unusual conditions were compared with routine monthly measurements on the same animals, significant increases in resistance were found at oxidant levels of approximately 0.30 ppm or more and, also, in the presence of approximately 40% of alert level of the oxides of nitrogen, carbon monoxide, and hydrocarbons. (Authors' Abs.)

608

Thomas, H. V., P. K. Mueller, and R. Wright.
RESPONSE OF RAT LUNG MAST CELLS TO NITROGEN DIOXIDE INHALATION. Jour. Air Poll. Control Assoc., v. 17: 33-35, 1967.

Young rats weighing 140-50 g were exposed to 1 ppm NO_2 for 2 hrs. One group was killed immediately, and another group 24-7 hrs after exposure. A 3rd group was exposed to 0.5 ppm NO_2 for 4 hrs and killed immediately. Standard histological preparations were made. The cells of the animals exposed to

NO_2 revealed rupture and loss of cytoplasmic granules with some disorientation. These changes were observed in the pleura, bronchi, and surrounding tissue with the effects more marked in the mediastinum. These findings indicate that 24 hrs or more are required to reverse the acute effects of NO_2 inhalation. The toxicological implications are discussed. (Chem. Abs.)

609
Toth, B., and P. Shubik.
CARCINOGENESIS IN AKR MICE INJECTED AT BIRTH WITH BENZO(A)PYRENE AND DIMETHYLNITROSAMINE. Cancer Res., v. 27: 43-51, Jan. 1967.

Newborn AKR mice were injected subcutaneously with either 200 μg of dimethylinitrosamine (DMN). The BP was found to result in a more rapid occurrence of malignant lymphomas than observed in the controls and to result in many lung adenomas. The DMN had no apparent effect on the development of virally medicated lymphomas but resulted in the appearance of benign and malignant liver tumors and lung adenomas. (APTIC Abs.)

610
Toth, B. and P. Shubik.
MALIGNANT LYMPHOMAS: POSSIBLE INTERACTION PROBLEMS BETWEEN CHEMICAL AND VIRAL INDUCING AGENT. Nat. Cancer Inst. Monogr., No. 22: 313-328, 1966.

Induction of malignant lymphomas by chemical carcinogens were studied in Swiss and AKR mice, golden hamsters, and Lewis rats. Tumors were developed in mice only. Attempts were made to transfer Swiss mice lymphomas by cell-free filtrates as well as by nucleic acid extracts. The cell-free filtrate was successful initially in transmission of the lymphoma, but this subsequently failed. The nucleic acid transmission was also negative. Chemical carcinogens were observed to influence the development of virus-induced malignant lymphomas. If in AKR mice the leukemogenic virus (present at birth) is treated with benzo(α)-pyrene, activation of a neoplastic process might occur. If dimethylnitrosamine is used instead, its independent action of producing hepatic and pulmonary tumors occurs. The neoplastic response of the combined effect of x-irradiation and radiation-induced lymphoma virus in C 57BL exceeded the simple additive effect and led to the suggestion of synergistic action between them. (Chem. Abs.)

611

Toth, B., and P. Shubik.
TOXIC EFFECTS OF 7, 12-DIMETHYLBENZ (A) - ANTHRACENE IN NEWBORN AND ADULT SWISS MICE. Nature, v. 211: 428-429, 1966.

The present findings show that when a carcinogenic dose of DMBA [7, 12-dimethylbenzanthracene] is administered on a strictly body-weight basis to 2 age groups of animals, it is more toxic to newborn than to adult Swiss mice. (Authors' Abs.)

(e) Health Effects - Humans

612

Anderson, W. A. D.
CONTRIBUTIONS OF PATHOLOGY TO PROBLEMS OF HUMAN AND EXPERIMENTAL LUNG CANCER. Ward Burdick Award Address. Amer. Jour. Clin. Pathol., v. 46: 1-26, 1966.

Recognition of the frequency of lung cancer by pathologists and clinicials was unexplainably delayed until recent years. Morphologic studies have shown that lung cancers can be separated into a few groups which differ in their biologic nature, natural history, pathogenesis, and probably in their etiology. The several types of bronchial adenomas are distinct from other lung cancers, as are pleural mesotheliomas, but the so-called alveolar cell carcinomas are infrequent as a distinct variety. Histologic classifications and their criteria in bronchial carcinoma are so variable that many statistical studies appear to have little validity. The importance of metaplasia and atypical hyperplasia in relation to lung cancer, and particularly scar cancer, is evident from many studies. The frequency of asbestos bodies demonstrable in the lungs (20-30% of adults) has possible potential importance in pulmonary cancer to a degree still to be assessed. Lung cancers morphologically similar to human lung cancers can be produced in rats by long-term inhalation of an exogenous carcinogenic agent, 3-nitro-3-hexene. (Author's Abs.)

613

Ayer, H. E.
AEROSOL RESEARCH AT THE DIVISION OF OCCUPATIONAL HEALTH, PUBLIC HEALTH SERVICE. Jour. Air Poll. Control Assoc., v. 17: 585, Sept. 1967.

The types of research discussed include: (1) the generation of free asbestos fibers by the decomposition of brake shoes, (2) the aerodynamic calibrations of size-selective samplers, and (3) the monitoring of occupational exposures to airborne particulates. (Biol. Abs.)

614

Bader, M. E., R. A. Bader, A. S. Tierstein, and others.
PULMONARY FUNCTION IN ASBESTOSIS: SERIAL TESTS IN A LONG-TERM PROSPECTIVE STUDY. Ann. New York Acad. Sci., v. 132: 391-405, 1965. (Presented at: Symposium Biological Effects of Asbestos, New York, Oct. 19-21, 1964).

In 1954-1955, pulmonary physiological studies in 17 asbestos workers revealed the characteristic pattern of alveolar-capillary block syndrome. These patients were withdrawn from industrial exposure. Follow-up measurements were made in 13 patients. These included vital capacity, maximum breathing capacity, arterial O_2 saturation at rest and with exercise, and arterial pCO_2 and pH. Of the parameters studied, vital capacity was the most sensitive index of progression of the disease. Its ease of application, availability, and repeatability all recommend it for use in the frequent assessment of workers exposed to asbestos dust. (Biol. Abs.)

615

Blanchard, R. L.
CONCENTRATIONS OF Pb^{210} and Po^{210} IN HUMAN SOFT TISSUES. Health Phys., v. 13: 625-632, 1967.

Concentrations of Pb^{210} and Po^{210} in tissues from twenty individuals are reported. The tissues investigated were the kidney, liver, lung, pancreas, spleen, gonads, thyroid and heart. The two highest average Po^{210} concentrations were 14.5 and 11.3 pCl/kg in liver and kidney, respectively. Average concentration in gonads, lung and thyroid was about one-half as great, and the least amounts of Pb^{210} were found in the spleen, pancreas and heart. Higher concentrations of Po^{210} were found in tissues of cigarette smokers than nonsmokers. Except for the lung, however, the differences were not significant. The Po^{210}/Pb^{210} activity ratio varied from < 1 to >1 in all tissue types, except for the heart for which there were too few samples to be meaningful. The amount of Po^{210} unsupported by its Pb^{210} parent was greatest in the kidney. The dose rates delivered by the Po^{210} to the various tissues are discussed. (Author's Abs.)

616
Blanchard, R. L.
CORRELATION OF LEAD-210 WITH STRONTIUM-90 IN HUMAN BONES. Nature, v. 211: 995-996, 1966.

Results of this study indicate that a correlation exists between Pb^{210} and Sr^{90} in the human skeleton, and also support the fallout hypothesis which postulates contamination of the environment with Pb^{210}. The similar behavior of Pb^{210} and fission products in the environment, as noted in earlier reports is also demonstrated. The relative dose Pb^{210}/Sr^{90}, delivered to infant bones, based on the average Pb^{210}/Sr^{90} activity ratio, was calculated to be 3:4. If the nuclear test ban treaty continues, the Pb^{210}/Sr^{90} ratio observed in this study will increase because the Pb^{210} concentration should remain relatively constant while the Sr^{90} concentration slowly decreases. (Biol. Abs.)

617
Blanchard, R. L.
RELATIONSHIP BETWEEN Po^{210} AND Pb^{210} IN MAN AND HIS ENVIRONMENT. In: Proc. Internat. Symposium Radioecological Concentration Processes, Stockholm, Sweden, Apr. 25-29, 1966. New York, Pergamon Press, 1967, p. 281-296.

Human soft tissue and bone were investigated for their content of Pb^{210} and Po^{210}; Ra^{226} and Sr^{90} measurements were included in the study of human bone. The highest average concentrations of Po^{210} in soft tissue were 14.3 and 10.4 pCi/kg in the liver and kidney, respectively. Average concentrations in the gonads, lung and thyroid were approximately 1/2 as great, and the least Po^{210} was in the spleen, pancreas and heart. There was a difference in the concentration of Po^{210} between smokers and nonsmokers. The concentration of Pb^{210} and Po^{210} in the same tissue types of different subjects varied considerably. The variation was greatest in the kidney (1.8-34.0 pCi/kg) and least in the pancreas (0.8-4.9 pCi/kg). The Pb^{210} activity ratio varied from < 1 to > 1 in all tissues except the lung, in which the ratio varied from 0.5 to 1.0. The greatest amount of unsupported Po^{210} was in the kidney. In all but 2 cases, the activity ratio found in the liver was near 1. A linear correlation was observed between Pb^{210} and Sr^{90} in human bone. The linear correlation coefficients calculated for Pb^{210} and Sr^{90} in the two age groups investigated, two days to one year and 4-23 yr, were 0.89 and 0.67 respectively. No correlation was observed between Ra^{226} and Pb^{210}. A number of environmental samples and caribou meat and bone samples from Alaska were also investigated to gain more information on the concentration of Po^{210} in the food chain of Alaskan Eskimo. (Biol. Abs.)

618
Bouhuys, A.
BYSSINOSIS IN TEXTILE WORKERS. Trans. New York Acad. Sci., v. 28: 480-490, 1966.

The prevalence of byssinosis among cotton, flax, and hemp workers was established, in many countries, by epidemiological surveys and pulmonary function tests. The disease is characterized by asthmalike symptoms on first working days after absence from work, and by gradual development of irreversible ventilatory insufficiency during prolonged exposure to biologically active textile dusts. Cases of byssinosis were observed in the USA by several investigators, but its degree of prevalence was not established. Byssinosis is caused by inhalation of cotton, flax, or hemp dusts in industry. The acute symptoms of byssinosis can be reproduced in healthy subjects, and these can be explained by the presence, in the dusts, and in bracts from cotton bolls, of a water-soluble, nonantigenic histamine-releasing agent which is active in human lungs but not in the lung tissue of guinea pig, rat, cat, sheep or pig in vitro. This agent is very likely identical with the water-soluble bronchoconstrictor agent, present in bracts of the cotton boll, which affects human subjects but not guinea pigs, in vivo. (Author's Abs.)

619
Bouhuys, A.
RESPONSE TO INHALED HISTAMINE IN BRONCHIAL ASTHMA AND IN BYSSINOSIS. Amer. Rev. Respiratory Diseases, v. 95: 89-93, 1967.

The clinical symptoms of byssinosis are similar to those of bronchial asthma; however, the two diseases differ with regard to their pathogenesis and to the circumstances in which symptoms develop. The present study confirms that hypersensitivity to inhaled histamine is a common finding in bronchial asthma, and shows that such a hypersensitivity is not a regular finding in byssinosis. The interpretation of histamine inhalation tests in patients with obstructive ventilatory disease is discussed and some of its difficulties are pointed out. A conclusion with regard to smooth muscle sensitivity to an inhaled agent can be made with some confidence from such tests only if the subject had no evidence of an obstructive ventilatory defect prior to inhalation of the agent. (Author's Abs.)

620
Bouhuys, A. and B. Jonson.
ALVEOLAR PRESSURE, AIRFLOW RATE, AND LUNG INFLATION IN MAN. Jour. Appl. Physiol., v. 22: 1086-1100, 1967.

Transairway pressure (Paw = Palv - Pao), flow rate (V), and thoracic gas volume (TGV_{Palv}) were measured simultaneously in 5 healthy subjects, at up to maximal flows and over nearly the full vital capacity [VC], during rebreathing at BTPS [body temperature and pressure saturated with water vapor] conditions. Isovolume pressure-flow (IVPF) curves and volumeflow (VV) diagrams were obtained. The constants in equations describing Paw-V relations were obtained at different lung inflations. IVPF points are not unique under some conditions: during inspiration Raw depends on preinspiratory volume (Raw higher during inspirations from near residual volume); during expiration considerable IVPF variability occurs at near-maximum flows. The latter phenomenon is discussed in terms of optimal and suboptimal Paw-V̇ relations, depending on volume and flow history as well as on sudden pressure transients in the dynamically compressed airway segment. Histamine inhalation caused marked, dose-related, changes of expiratory IVPF points at small TGV, in the absence of dyspnea. Variations in Pst(l) largely account for between-subset variation of "relative conductance" (standardized for lung size), and for Gaw changes with lung inflation within subjects. Instantaneous expiratory power may exceed 50 w during forced expirations. (Authors' Abs.)

621

Bouhuys, A., and P. J. Nicholls.
THE EFFECT OF COTTON DUST ON RESPIRATORY MECHANICS IN MAN AND IN GUINEA PIGS. In: Inhaled Particles and Vapours II. Ed. by C. N. Davies. London, Pergamon Press, 1967, p. 75-83. (Proc. Internat. Symposium, Cambridge, England, Sept. 28-Oct. 1, 1965).

Inhalation of aerosols of extracts of cotton dust, bracts and pericarp did not cause changes in breathing rate, tidal volume, pulmonary resistance and compliance in spontaneously breathing, unanesthetized guinea pigs. Inhalation of bracts extract caused dyspnea, chest tightness and concomitant changes in respiratory mechanics in three human subjects. The subjects experienced none of these effects after a second exposure 24 hr later, while a third exposure, 6 or 8 days after the first, was again effective. A fourth subject showed changes in mechanics after one exposure but had no subjective distress. An extract of pericarps had no effect in two of these subjects. Because of slow onset of these respiratory effects (10-30 min exposure), and because of the tachyphylaxis which was observed, it appears likely that the agent responsible for the respiratory effects of bracts extract in man is identical with the histamine releasing activity in this extract. It is concluded that this agent is probably responsible for many of the acute symptoms of byssinosis in cotton workers. (APTIC Abs.)

622
Brice, R. M., and J. F. Roesler.
THE EXPOSURE TO CARBON MONOXIDE OF OCCUPANTS OF VEHICLES MOVING IN HEAVY TRAFFIC. Jour. Air Poll. Control Assoc., v. 16: 597-600, 1966.

Carbon monoxide and hydrocarbons were sampled at operator's nose height inside vehicles moving in moderate to heavy traffic in six cities. The samples were integrated over 20-30 minutes by collection in Mylar bags. Carbon monoxide and hydrocarbons were analyzed by infrared and flame ionization, respectively, with instruments at the Continuous Air Monitoring Program (CAMP) station in each city. Detector tubes for carbon monoxide were also used to determine 5-min concentrations at suscepted high points in the field. Estimates of traffic density were made. Three types of traffic arteries were considered: heavily traveled, wide expressways, main city streets with slow-moving traffic. Integrated half-hour CO concentrations obtained within the vehicles while in traffic were generally considerably higher than the concurrent concentrations measured at the CAMP sites. In-traffic CO values in all cities sampled exceeded 30 ppm in at least 10% of the integrated samples. The range of city average was 21-39 ppm carbon monoxide and the range of individual integrated samples was 7-77 ppm of carbon monoxide. (Authors' Abs.)

623
Carnes, W. H., and L. E. Moses.
THE RELATIVE EFFECTS OF SOME AIR POLLUTANTS ON THE HUMAN RESPIRATORY EPITHELIUM. Proc. 3rd Quadrennial Conf. on Cancer: Lung Tumors in Animals, Perugia, Italy, June 24-29, 1965. 1966, p. 479-486.

There is a strong correlation between smoking and the types of lesions of the tracheo-bronchial epithelium. Lack of significant correlations between the same abnormalities and occupation or residence indicates that the types of air pollution exposure dependent upon these factors have not produced a comparable effect on the respiratory epithelium. (Biol. Abs.)

624
Coburn, J. W., and R. C. Reba.
POTASSIUM DEPLETION IN HEAT STROKE. A POSSIBLE ETIOLOGIC FACTOR. Milit. Med., v. 131: 678-687, 1966.

A reduced exchangeable K content was found in a patient with fatal heat stroke. Various aspects of the etiology and pathogenesis of heat stroke are reviewed. The features associated with heat exposure which would be expected to result in reduced body K are presented, and data are collected which indicate that K depletion may have been frequent among previously reported heat stroke victims. An association between K depletion and heat stroke could result if K depletion increased the susceptibility of a person to heat injury. Although this report does not establish a cause and effect relationship between K depletion and susceptibility to heat stroke, it does suggest that such a relationship might exist. (Authors' Abs.)

625

Consolazio, C. F., R. A. Nelson, L. O. Matoush and others.
ENERGY METABOLISM AT HIGH ALTITUDE (3,475 m).
Jour. Appl. Physiol., v. 21: 1732-1740, 1966.

Maximal work capacity (Vo_2) on the bicycle ergometer was decreased in three groups of men, one group acclimated to sea level, and two groups acclimated to 1,610 m. At 3,475 m maximal Vo_2 in ml/kg body weight per minute was reduced by 17% for the sea level group, and by 10% for the group from 1,610 m. Although there was a difference of approximately 7% in Vo_2 between sea level and 1,610 m there was no measurable beneficial effect of acclimatization at 1,610 m in improving maximal work at 3.475 m. Maximal work capacity and maximal Vo_2 did not improve over a 20-day period at altitude. VE STPD [pulmonary minute ventilation at standard temperature and pressure, dry air] was decreased, and VE BTPS [pulmonary minute ventilation at body temperature and pressure, saturated with water vapor] increased on arrival at altitude with a gradual increase in both during prolonged exposure. Pulse rates at rest, and moderate exercise, were consistently high at high altitudes, whereas the maximal pulse rates gradually declined. Oxygen consumption at the basal, sitting rest, and moderate exercise states was not markedly changed by altitude. The physiological cause for the cessation of maximal work at altitude remains obscure. Under the conditions of this study: (a) the 1,610-m elevation did not seem to be beneficial in improving the maximal work at 3,475 m, (b) a 20-day acclimatization period at 3,475 m did not result in a superior submaximal or maximal work performance on return to sea level, and (c) individuals can adequately perform submaximal work even after the initial high-altitude exposure. (Authors' Abs.)

626

Crable, J. V., R. G. Keenan, F. R. Wolowicz and others.
THE MINERAL CONTENT OF BITUMINOUS COAL MINERS' LUNGS. Amer. Indus. Hyg. Assoc. Jour., v. 28: 8-12, Jan.-Feb. 1967.

The authors analyzed the coal, quartz, and total dust content, in addition to the major, minor, and trace metal concentrations, in the lungs of bituminous coal miners with occupational histories extending up to 50 years. (Publ. Health Eng. Abs.)

627

Dalhamn, T., and R. Rylander.
TAR CONTENT AND CILIOTOXICITY OF CIGARETTE SMOKE. Acta Pharmacologica et Toxicological (Kobenhavn), v. 25: 369-372, 1967.

The significance of tar content in cigarette smoke as a determinant of the ciliotoxic effect under exposure conditions which resemble human exposure was determined by using animal preparations in vivo. Cats were anesthetized and their tracheal cilia observed. Cigarettes of 5 different tar levels were used. An increase in the tar content resulted in an increased ciliotoxicity. The possible significance of this finding in connection with human exposure to tobacco smoke is discussed. (Chem. Abs.)

628

Freis, E. D., W. C. Heath, P. C. Luchsinger and others.
CHANGES IN THE CAROTID PULSE WHICH OCCUR WITH AGE AND HYPERTENSION. Amer. Heart Jour., v. 71: 757-765, 1966.

The carotid pulse wave was recorded in normal subjects of various ages and in hypertensive and atherosclerotic patients, using a water-filled transducer with improved performance characteristics. The feasibility of analyzing such waves by electronic data processing has been demonstrated. The changes in the carotid pulse wave occurring with age are similar to those found in hypertension but are of lesser degree. The wave contains 2 systolic maxima, the 1st related temporally to peak aortic flow and the 2nd to maximum aortic pressure. With increasing age or hypertension, the 2nd maximum and the incisura rise in relation to the 1st systolic maximum. Similar changes can be induced with agents which increase total peripheral resistance, whereas opposite changes observed in the carotid pulse wave are a reflection primarily of central arterial distensibility. The potential usefulness as well as the limitations of the method are discussed. (Authors' Abs.)

629

Knudson, R. J., and H. P. Constantine.
AN EFFECT OF ISOPROTERENOL ON VENTILATION-PERFUSION IN ASTHMATIC VERSUS NORMAL SUBJECTS. Jour. Appl. Physiol., v. 22: 402-406, 1967.

A fall in PaO_2 was observed following the inhalation of isoproterenol aerosol in 10 symptomatic asthmatics. In 4 asthmatic and 2 normal subjects, measurements were made of VC and $FEV_1\%$, RA and FRC in the body plethysmograph, and resting steady-state PA_{O_2}, Pa_{O_2}, (A-a)D, VD, DL_{CO} and FCO. The studies were repeated after administration of isoproterenol aerosol. In the asthmatics there was improvement of the RA and $FEV_1\%$, but an increase in the already large (A-a)D and a fall in the FCO and DL_{CO}. These effects were not seen in the normal subjects. It is suggested that the administration of isoproterenol aerosol to asthmatics increases the ventilation of the already well-ventilated portions of lung to the detriment of the poorly ventilated portions, further increasing the unevenness of distribution VA/Q ratios throughout the lung. (Authors' Abs.)

630

Kowitz, T. A., R. C. Reba, R. T. Parker and others.
EFFECTS OF CHLORINE GAS UPON RESPIRATORY FUNCTION.
Arch. Environ. Health, v. 14: 545-559, Apr. 1967.

On March 28, 1961, approximately 150 longshoremen were accidentally exposed to chlorine gas. Eleven subjects who were hospitalized because of respiratory distress were evaluated serially with respiratory function tests on four occasions during the ensuing two- to three-year period. Fifty nine subjects, including the 11 mentioned above, had a complete clinical and respiratory function evaluation between two and three years following the incident. (Authors' Abs.)

631

McDonald, R. D., C. H. Bachman, and P. J. Lorenz.
SOME PSYCHOMOTOR AND PHYSIOLOGICAL TESTS ON HUMANS EXPOSED TO AIR IONS. Aerospace Med., v. 38: 145-148, 1967.

Humans were exposed to air ions by inhalation only. The ion current to each subject was measured. Both psychomotor and physiological tests were performed with ions of both polarities. Reaction time measurements under ionization were ambiguous. In a vigilance task both negative ions and positive ions reduced the number of omissions, the positives being most effective. Neither polarity effected the heart rate. Reduction in respiration rates occurred for both polarities of ions as well as the control during the ion exposure. The reduction for positive ions was greater than for the control, the reduction for negatives was less than for the control. Measurements of DC [direct current] potential between forehead and ear showed no correlation with ion treatment. (Authors' Abs.)

632

Meyer, J. S., F. Gotoh, and Y. Takagi.
INHALATION OF OXYGEN AND CARBON DIOXIDE GAS: EFFECT ON COMPOSITION OF CEREBRAL VENOUS BLOOD [IN CEREBROVASCULAR DISEASE]. Arch. Internal Med., v. 119: 4-15, 1967.

Inhalation of various gas mixtures was used to challenge the capacity of cerebral vasomotor reactivity in subjects with and without cerebrovascular disease and of different age groups. Effects of inhalation of 100% O_2, 5% CO_2 plus O_2 and 5% CO_2 plus air on the composition of arterial and jugular blood were measured. Blood PO_2[O_2 tension], PCO_2 [CO_2 tension], and pH were continuously recorded. The increase of cerebral venous PO_2 after inhalation of 100% O_2 or 5% CO_2 plus O_2 was far less than that in arterial blood. Inhalation 100% O_2 caused a slight increase in arterial PCO_2 due to the Haldane effect. The increase of cerebral venous PO_2 by inhalation of 5% CO_2 in air was significantly higher in the group over 35 years than in the younger group. In the presence of cerebral arteriovenous malformation, the rise of cerebral venous PO_2 caused by 100% O_2 inhalation was significantly higher than that found in the absence of vascular disease to the brain due to arteriovenous shunting. In occlusive cerebrovascular disease, elevation of cerebral venous PO_2 after inhalation of 5% CO_2 plus O_2 or 5% CO_2 plus air was significantly smaller than that found in subjects without cerebrovascular disease but nevertheless occurred. In the presence of carotid occlusion, the increase of cerebral venous PO_2 induced by inhalation of 5% CO_2 plus air was significantly smaller than found in subjects with middle cerebral artery occlusion or stenosis of cerebral vessels. There was no significant difference between the latter 2 groups. No relationship was found between the state of consciousness or any electroencephalogram abnormality and the cerebral vasomotor response to the challenge gas mixtures. Inhalation of 100% O_2 or 5% CO_2 plus O_2 increased the O_2 available to the ischemic or anoxic brain and appeared to be a justifiable form of therapy in occlusive cerebrovascular disease (stroke). (Authors' Abs.)

633

Nicholls, P. J., G. R. Nicholls, and A. Bouhuys.
HISTAMINE RELEASE BY COMPOUND 48/80 AND TESTILE DUSTS FROM LUNG TISSUE IN VITRO. In: Inhaled Particles and Vapours II. Ed. by C. N. Davies, London, Pergamon Press, 1967, p. 69-74. (Proc. Internat. Symposium, Cambridge, England, Sept. 28 - Oct. 1, 1965).

This study was undertaken because of divergent conclusions about the histamine-releasing properties of cotton dust. Histamine release was studied in both human and animal lung tissue in vitro. Extracts of cotton, flax and hemp dusts, and of the bracts of the cotton boll do not release histamine from guinea pig, rat, cat, sheep and pig lung tissue in vitro. They do, however, release significant amounts of histamine from human lung tissue in vitro, under similar experimental conditions. Extracts of pericarps, another component of the cotton boll, were without effect in both animal and human lung tissue. The results suggest that the histamine-releasing activity of cotton dust is due to the presence of bract fragments in the cotton processed in the mills. (APTIC Abs.)

634

Paulus, H. J. and T. J. Smith.
ASSOCIATION OF ALLERGIC BRONCHIAL ASTHMA WITH CERTAIN AIR POLLUTANTS AND WEATHER PARAMETERS.
Internat. Jour. of Biometeorol., v. 11: 119-127, Mar. 1967.

Bronchial asthma in students at the University of Minnesota was studied in grain sensitive and in control groups to find the influence of air pollutants from nearby grain installations on this problem. Under relatively high dust conditions it was observed that grain sensitive students had a two-fold increase in asthma attacks while the controls showed no significant changes. A combined association of wind direction and relatively high dust conditions with asthma gave a correlation of higher significance in the grain sensitive group. Multiple associations indicated that this relationship is only weakly affected by seasonal and temperature changes. It was also observed that relative humidity conditions may significantly influence the effectiveness of the dust exposure in sensitive students. Weather parameters showed no association with asthma in the control group. (Authors' Abs., Modified)

635

Proctor, D. F., and H. N. Wagner, Jr.
MUCOCILIARY PARTICLE CLEARANCE IN THE HUMAN NOSE.
In: Inhaled Particles and Vapours II. Ed. by C. N. Davies, London, Pergamon Press, 1967, p. 25-33. (Proc. Internat. Symposium, Cambridge, England, Sept. 28 - Oct. 1, 1965).

To understand the role of the human nose in the disposition of inhaled particles one must know the circumstances under which nasal breathing is practiced, the character of nasal air flow (or oral air flow when it occurs), what particles are deposited within the upper air passages, and their ultimate fate. The early stages of an investigation of these problems in the living human are reported. Techniques for study of nasal air flow, and for the measurement of particle movement in the human nasal mucous stream are described. Nasal air flow patterns appear to be remarkably constant under varying conditions of flow. The transport of particles in the nasal mucous stream is comparable to mucociliary motion observed by others in experimental animals and in in vitro studies. (APTIC Abs.)

636

Robinson, J., and C. G. Hunter.

ORGANOCHLORINE INSECTICIDES: CONCENTRATIONS IN HUMAN BLOOD AND ADIPOSE TISSUE. Arch. Environ. Health, v. 13: 558-563, 1966.

The mean (geometric) concentrations of HEOD [dieldrin] in the whole blood and depot fat of 44 persons with no known occupational exposure were 0.0014 ppm and 0.22 ppm respectively; the corresponding concentrations of total DDT-type compounds were 0.013 and 4.0 ppm respectively. The ratio of the concentrations in the blood and depot fat were 159 and 306 for HEOD and total DDT-type compounds respectively. In these people no significant relationships were found for either type of compound between the concentrations in the whole blood and depot fat; this is considered to result from the errors present in the observations as a significant correlation is found as the results for males with elevated body burdens of HEOD (arising from occupational or deliberate exposure) are taken into account. No significant change in the HEOD concentration of the bloods of the general human population of England has occurred over the period 1962-1965. State of equilibrium was established between the intake and elimination of this compound. (Authors' Abs.)

637

Sharp, J. T., S. K. Sweany, and P. Van Lith.

PHYSIOLOGIC OBSERVATIONS IN DIFFUSE PULMONARY FIBROSIS AND GRANULOMATOSIS. Amer. Rev. Respiratory Diseases, v. 94: 316-331, 1966.

Of 61 men with diffuse pulmonary fibrosis or granulomatosis 3 had normal pulmonary function; 8 had isolated diffusion defects. Because of disproportionate impairment of different aspects of lung function, few inferences may be made from lung mechanics or spirometry about the normalcy of gas exchange. In restricted patients, lung compliance was consistently lower than predicted from the normal relationship between lung volume and compliance. This may be related to the greater inspiratory force available at the reduced lung volumes characteristic of such patients. Abnormal indices of alveolar mixing without abnormally decreased compliances on rapid breathing were present in a third or 44 unobstructed patients, suggesting that regional alveolar stiffening without obstruction was responsible for their uneven ventilation.

Forty-two of 59 patients had resting arterial hypoxemia. Their mean diffusing capacity averaged 1/2 the mean of patients without hypoxemia. Arterial hypoxemia was more severe than could be accounted for by the observed diffusion defect indicating a coexisting ventilation-perfusion defect. Correlation between hypoxemia and diffusing capacity impairment suggested a close association of ventilation-perfusion and diffusion defects. Eight patients with alveolar hypoventilation had severely impaired respiratory mechanics, the defect being purely restrictive in two. Fourteen patients with alveolar hyperventilation had mild mechanical abnormalities but serious impairment of oxygenation. (Authors' Abs.)

638

Sharp, J. T., P. Van Lith, and S. K. Sweany.
CLINICOPHYSIOLOGIC CORRELATIONS IN DIFFUSE PULMONARY FIBROSES AND GRANULOMATOSES. Amer. Rev. Respiratory Diseases, v. 94: 332-339, 1966.

Among 61 patients with diffuse pulmonary fibrosis of granulomatosis, disease-specific patterns of pulmonary functional impairment were not found. Selective and sometimes isolated impairment of diffusion was often seen, in nonspecific interstitial fibrosis. Patterns of pulmonary functional impairment specific to the stage of disease were seen only in sarcoidosis where patients who had had the disease longer had a greater prevalence of airway obstruction. Of 18 patients with clubbed digits all but one had arterial hypoxemia. Of the 42 patients with resting hypoxemia, only 16 were clubbed. While clubbing is a good indicator of hypoxemia, its absence is not a reliable basis for excluding hypoxemia. Clubbing was particularly common in nonspecific interstitial fibrosis and in fibrosis associated with bronchial and bronchiolar disease. Right heart failure was seen in 12 patients, usually as a pre-terminal event refractory to therapy. In 6 of the 12, failure was associated with purely restrictive ventilatory defects and in 5 of these the arterial CO_2 pressure P_{CO_2} was normal or low. The presence of a reticular as opposed to a purely nodular infiltration in the chest film was associated with an increased prevalence of hypoxemia, airway obstruction, lowered diffusing capacity and impaired distribution of inspired air. (Authors' Abs.)

639

Speizer, F. E., and N. R. Frank.
THE UPTAKE AND RELEASE OF SO_2 BY THE HUMAN NOSE. Arch. Environ. Health, v. 12: 725-728, 1966.

Measurements were made of the absorption and desorption of SO_2 in the upper respiratory tracts of seven healthy men breathing by nose. Virtually all of the inspired SO_2 was absorbed by the nasal mucosa. It was not possible to saturate the system during the period of study at the concentrations used. During expiration SO_2 was desorbed from the nasal mucosa in quantities which totaled approximately 15% of the original concentration inspired. An implication of this study is that chemically minute amounts of SO_2 (less than 1% of the inspired concentration) are, upon reaching the larynx and more distal airways, sufficient to initiate reflex changes in bronchomotor tone. (Authors' Abs.)

640

Spicer, W. S., Jr., and D. H. Kerr.
VARIATION IN RESPIRATORY FUNCTION: STUDIES ON PATIENTS AND NORMAL SUBJECTS. Arch. Environ. Health, v. 12: 217-226, 1966.

Daily measurement of the respiratory function of 17 patients with chronic obstructive pulmonary disease and of 11 normal subjects identified a day to day variation in the values obtained with the whole body pressure plethysmograph and with the spirometer. A significant percentage of the variance in these tests can be explained by the tendency for subjects to change together on a week to week basis and for subjects within disease groups to change together from day to day. The pattern of change in lower airway conductance and certain other respiratory function tests may provide a more sensitive index of the normal or disease state than the customary battery of tests performed on a single occasion. Environmental factors including air pollution and meteorological changes, would appear to fulfill the criteria of agents responsible for such patterns of change. (Authors' Abs.)

641

Spicer, W. S., Jr., W. A. Reinke, and D. H. Kerr.
EFFECTS OF ENVIRONMENT UPON RESPIRATORY FUNCTION: II. DAILY STUDIES IN PATIENTS WITH CHRONIC OBSTRUCTIVE LUNG DISEASE. Arch. Environ. Health, v. 13: 753-762, 1966.

The effects of selected meteorologic changes and air pollutants upon the mean daily values of ten respiratory function tests obtained from small groups of patients with chronic bronchitis or bronchial asthma has been assessed for two 7-week study periods. A logical biostatistical approach, which places chief reliance upon the multiple regression technique, was used to sort out major effects from a mass of data. The most important environmental-physologic relationships appeared to be those associated with temperature, wind speed, barometric pressure, and SO_2 levels. Two distinct patterns of physiologic response were found. In the final analyses total lung capacity (TLC) and residual volume (RV) were used to exemplify the volume group and airway resistance at functional residual capacity and percentage of the forced vital capacity exhaled in 3 sec ($FEV_{3.0\%}$) the resistance group. Airway resistance and TLC increased as temperature decreased. Airway resistance increased and $FEV_{3.0\%}$ fell in both patient groups and RV increased in patients with asthma either 14 or 38 hr (or both) following a rise in SO_2 in the second study where the range of SO_2 levels was greater than in the first study. Airway resistance increased and $FEV_{3.0\%}$ decreased 24 hr after a fall in barometric pressure while TLC and RV rose in patients with chronic bronchitis 14 hr after a drop in wind speed. Particular care has been taken to point out that a direct cause and effect relationship cannot be implied from these significant findings. (Authors' Abs.)

642
Spodnik, M. J., Jr., G. D. Cushman, D. H. Kerr, and others.
EFFECTS OF ENVIRONMENT ON RESPIRATORY FUNCTION. WEEKLY STUDIES ON YOUNG MALE ADULTS. Arch. Environ. Health, v. 13: 243-254, 1966.

One hundred young white male college students were divided at random into 7 groups for evaluation of respiratory function using the whole body pressure plethysmograph. A different group was studied on each Thursday afternoon, in rotation, during the period of October 22 through May 27. Variation in group mean respiratory function occurred which resembled a single cycle with poorest function in February-March. The subjects within groups underwent parallel changes in function. After correction of intergroup differences, these respiratory function changes correlated significantly and best with temperature outside on the day of measurement. Airway resistance increased as temperature decreased. Subjects with a history of asthma, but presently asymptomatic, were found to have significant abnormal respiratory function in comparison to their normal classmates and responded differently to temperature change. (Authors' Abs.)

643
Thomas, H. V., B. K. Milmore, G. A. Heidbreder, and others.
BLOOD LEAD OF PERSONS LIVING NEAR FREEWAYS.
Arch. Environ. Health, v. 15: 695-702, 1967.

A study was made to determine whether persons living near freeways in Los Angeles County have increased levels of Pb in blood. Fifty adults who had resided for at least 3 years within 250 ft of a freeway were compared with 50 who had resided for a like period near the ocean or at least 1 mi from a freeway. Average blood Pb levels were substantially higher in the population sample living near the freeway. However, these blood Pb levels were similar to other Los Angeles populations and lower than those reported for some other urban populations. The atmospheric Pb concentration is lower near the ocean than in central Los Angeles. It is higher in heavy freeway traffic streams than in downtown areas. However, available evidence suggests that at a distance of 150 ft from freeway traffic lanes the concentration of lead in the atmosphere is about the same as at monitoring stations in the central metropolitan area. The observed difference between the 2 population samples is consistent with the existence of coastal-inland atmospheric Pb and blood Pb gradients within the Los Angeles basin. A specific effect of residential proximity (25 to 250 ft) to a freeway was not demonstrated. (Authors' Abs.)

644

Thomson, J. G.

ASBESTOS AND THE URBAN DWELLER. Ann. New York Acad. Sci., v. 132: 196-214, 1965. (Presented at: Symposium Biological Effects of Asbestos; New York, Oct. 19-21, 1964)

The extent of inhalation of asbestos fibers by urban dwellers was investigated by counting asbestos bodies in smears from the lung bases from 500 consecutive autopsies in subjects over the age of 15 in Cape Town, South Africa, and Miami, Florida. The results were similar in the 2 cities, and no less than 30% of the males and 20% of the females showed asbestos bodies. In 85% of the positive cases the bodies were scanty, were not associated with pulmonary changes, and were regarded as the result of contamination of the urban atmosphere. In 6% of all the males examined the bodies were numerous and were presumably of occupational origin. The tendency for asbestos fibers too long to be phagocytosed to move downwards by gravity before they become asbestos bodies leads to concentration at the lung bases, and small doses can have a cumulative effect. As a limit basal asbestosis may be associated with malignant mesothelioma of pleura and peritoneum. An increase in this tumor is forecast as the main ground for regarding asbestos as a potential urban hazard. While that view is conjectural, the finding of abundant asbestos bodies in the lung bases of 1 in 17 of the male hospital population suggests that the occupational hazard from asbestos is greater and more diversified than is at present realized. (Biol. Abs.)

645
Tye, M. J., K. Hashimoto, and F. Fox.
TALC GRANULOMAS OF THE SKIN. Jour. Amer. Med. Assoc., v. 198: 1370-1372, 1966.

Hundreds of talc granulomas of the skin had developed in a 45-yr -old woman. The talcum powder gained entrance through the skin at the sites of draining or incised furuncles. Electron microscopic studies showed the electron-dense lamellae to be morphologically identical to that of talc in many phagocytic cells. X-ray diffraction studies confirmed the foreign crystal to be talc. (Biol. Abs.)

646
Wayne, W. S., P. F. Wehrle, and R. E. Carroll.
OXIDANT AIR POLLUTION AND ATHLETIC PERFORMANCE. Jour. Amer. Med. Assoc., v. 199: 901-904, 1967.

The effect of Los Angeles' oxidizing type of air pollution on athletic performance was studied in 21 competitive meets of high school cross-country track runners from 1959 to 1964. Since running times tend to improve throughout the season, team performance at a meet was evaluated by determining the percent of boys who failed to improve when their running time was compared to that run at the previous meet on the same course. The highest correlation to team performance is that of the oxidant level in the hour before the race. Neither CO, temperature, nor humidity shows any relationship to performance. The specificity to the effect to a biologically meaningful time and the very high correlation are convincing evidence of a cause and effect relationship. The mechanism by which oxidants affect performance may be directly physiological or may be decreased motivation due to discomfort. (Authors' Abs.)

647
Whittenberger, J. L.
ANALYSIS OF BONE SAMPLES FROM PATIENTS WITH PROVEN OSTEOGENIC SARCOMA FOR NATURALLY-OCCURRING RADIOISOTOPES. ANALYSIS OF SOFT TISSUES FOR α-EMITTING RADIOELEMENTS, WITH PARTICULAR REFERENCE TO POLONIUM INHALED IN CIGARET SMOKE AS A SOURCE OF RADIATION EXPOSURE. Harvard School of Public Health, Boston, Mass., 1966, 60p. (Report No. HUX-3170-1) (AEC Accession No. 41191)

The studies described in this report, with one exception, have been concerned with low levels of naturally-occurring radioelements, levels normally found in our environment. The concentrations of ^{210}Pb, ^{226}Ra, and ^{228}Th observed in the bones of individuals with osteogenic sarcoma were found to be no higher than those in the bones of controls. The present study does not directly implicate these isotopes as agents in the spontaneous production of osteogenic sarcoma in populations without occupational or iatrogenic exposure to internal emitting bone-seeking radioelements. (Chem. Abs.)

VII. PLANTS

648

Altshuller, A. P., and I. R. Cohen.
ATMOSPHERIC REACTIONS OF PROPIONALDEHYDE IN AIR MIXTURES. Atmos. Environ., v. 1: 319-325, May 1967.

The presence of a type of oxidant that has not been identified previously in atmospheric type systems has been discovered in the propionaldehyde ultraviolet light reactions. It has not been shown whether ethyl hydroperoxide or other n-alkyl hydroperoxides are the phytotoxicants formed when aldehydes are photooxidized. Fumigations of plant species with n-alkyl hydroperoxides are needed to determine whether this product can account for the phytotoxic properties of the irradiated system. These experimental results suggest that aldehyde reactions can become increasingly important if atmospheric concentrations of nitrogen oxide are reduced to low levels. Additional investigations of related systems containing aldehydes are needed to further clarify the role of aldehydes in atmospheric reactions. (Authors' Abs.)

649

Daines, R. H., E. Brennan, and I. Leone.
AIR POLLUTANTS AND PLANT RESPONSE. Jour. Forestry, v. 65: 381-384, 1967.

Plant damage from air pollution in the eastern United States was only recognized around individual large emitters prior to the early 1950's. The damage to vegetation was frequently severe over a limited area. Today most of these large source emitters have corrected their problem. However, now instead of limited areas showing severe injury to many plants, large areas showing injury to only the more sensitive plants occur. The pollutants that we are most concerned with now have their origin in combustion with sizable amounts of SO_2 coming from the burning of coal, oil, and plant material. Nitrogen oxides are generated in the elevated temperatures produced by fires and unburned organic compounds escape into the atmosphere from all combustion sources. Of these pollutants SO_2 may injure plants. In addition to these primary products of combustion, new compounds are formed in the sunlight from reactions (photochemical) that require energy from the sun to occur. From these reactions such compounds as ozone, PAN (peroxyacetylnitrate) and its analogues and perhaps other plant toxicants are formed. Each of these toxic compounds is injurious to certain sensitive plant species at very low concentrations and each toxic pollutant produces symptoms in certain plants that may be distinguished from the other pollutants. The number of plants affected by gases that have their origin in combustion are increasing with time and the area showing such injury is also expanding. Since these pollutants are dependent upon automobile exhaust and effluents from coal, oil, and rubbish burning, such pollutants will increase with our expanding population and industrial growth unless controlled. (Authors' Abs.)

650
Darley, E. F., S. Lerman, and R. J. Oshima.
PLANT EXPOSURE CHAMBERS FOR DUST STUDIES. Jour. Air Poll. Control Assoc., v. 18: 28-29, Jan. 1968.

Plant exposure chambers are described which provide for uniform application of dusts at rates simulating those of natural conditions. One set of chambers receives artificial light and is used for short term exposures. A second set of larger chambers receives natural light and provides for dusting plants daily to maturity. A feeder assembly from a Bacho Microparticle Classifier serves as the means of introducing the dust at the top of the chamber. A whirling, counter-airflow stream is introduced a few inches below the feed nozzle to assist in lateral distribution of the dust. Distribution is further enhanced by placing exposed plants on a turntable. Carbon filtered auxiliary air is supplied through a distribution system below the turntable. Variation of dust deposit at different heights above the outer two-thirds of the turntable does not vary more than 5%. (Authors' Abs.)

651
Darley, E. F., and J. T. Middleton.
PROBLEMS OF AIR POLLUTION IN PLANT PATHOLOGY. Rev. Phytopathology, v. 4: 103-118, 1966.

The damage caused to plants by the following pollutants is described: (1) ethylene, (2) hydrogen fluoride, (3) nitrogen dioxide, (4) ozone, (5) peroxyacyl nitrates, (6) sulphur dioxide, and (7) particulates. Histological changes in plants caused by these substances and factors of resistance and environment are considered. The sources and dispersal of the pollutants are discussed and also their control and possible methods for protection of plants against them. (Air Poll. Abs.)

652

Darley, E. F., C. W. Nichols, and J. T. Middleton.
IDENTIFICATION OF AIR POLLUTION DAMAGE TO AGRICULTURAL CROPS. Bull. Calif. Dept. Agric., v. 55: 11-19, 1966.

The damage to plants caused by the following air pollutants: (1) particulates, (2) ethylene, (3) fluorides, (4) nitrogen dioxide, (5) ozone, (6) peroxyacyl nitrates, and (7) sulphur dioxide is described.

653

Dugger, W. M., Jr., J. Koukol, and R. L. Palmer.
PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF ATMOSPHERIC OXIDANTS ON PLANTS. Jour. Air Poll. Control Assoc., v. 16: 467-471, 1966.

Photochemically produced oxidants in the atmosphere cause injury to plants primarily through inhibition of basic metabolic processes. Plants vary in their response to the oxidants and this variation must be dependent in part on the variation in metabolic activity with age or environmental conditions for growth, to a large degree not understood. Data are presented in this paper to show: (1) the changes in permeability of leaf tissue to exogenous substrate and in catabolic utilization of this substrate after exposure of plants to ozone but before visible symptoms appear; (2) the change in leaf carbohydrates as a result of exposure to ozone; (3) the protective effect of red light (700 mμ) during exposure of bean plants to peroxyacetyl nitrate (PAN); (4) the correlation of sulfhydryl (SH) content in bean leaf tissue with age of plants and light regime; and (5) effect of light regimen and age of plants on incorporation of C^{14} from C^{14}-PAN by bean leaf tissue. (Authors' Abs.)

654

Jacobson, J. S., D. C. McCune, L. H. Weinstein, and others.
STUDIES ON THE MEASUREMENT OF FLUORIDE IN AIR AND [MILO MAIZE, GLADIOLUS, ALFALFA, ORCHARD GRASS] PLANT TISSUES BY THE WILLARD-WINTER AND SEMIAUTOMATED METHODS. Jour. Air Poll. Control Assoc., v. 16: 367-371, 1966.

Determinations of F in plant tissues by the Willard-Winter and semiautomated methods have been studied for the presence of determinate and indeterminate errors by multiple linear regression analysis. The results have provided a better understanding of the magnitude of differences between tissue samples required for statistical significance and have suggested that the errors involved are much greater both in number and magnitude than usually assumed. The results have also established that the semiautomated method is a satisfactory alternative to the Willard-Winter method for determining the F content of plant tissues. Investigations of the sources of error in F determinations by the semiautomated method were carried out, and the results indicated a number of ways of reducing errors. Determinations of the F content of air by three methods were compared and studied to estimate the magnitude and locate the sources of error. Here, too, the results indicated that present estimates of the reliability of determinations of the F content of air may be overrated, and they have suggested that improvement in the means of collection of HF is the best way of improving reproducibility. (Authors' Abs.)

655

Jacobson, J. S., L. H. Weinstein, D. C. McCune, and others. THE ACCUMULATION OF FLUORINE BY PLANTS [PHASEOLUS VULGARIS, LYCOPERSICUM ESCULENTUM, GOSSYPLUM HIRSUTUM, KALANCHOË DAIGREMONTIANA]. Jour. Air Poll. Control Assoc., v. 16: 412-416, 1966.

The accumulation and distribution of fluorine (F) in plant leaves have been studied to better understand the response of plants to concentrations of atmospheric fluoride (F) that are similar to those found in urban or industrial areas. The results indicate that F from the air can be adsorbed to the surface of leaves as well as accumulated internally and that F in leaves can be translocated outward to the surface as well as upward to the tips. Fluorine injury and accumulation can be induced in any desired location on a gladiolus blade by restricting gas exchange of the blade, indicating that all parts of a blade are sensitive to F-induced injury. It is, therefore, suggested that the wide differences often found between plant species and varieties with respect to both susceptibility to injury and degree of F accumulation may be explained by differences in the means of accumulation, translocation, and distribution of F. Fluorine remains in a soluble form in plant leaves and maintains the chemical properties of free, inorganic F. The solubility and mobility of F and the ease of removal from plant tissues indicate that irreversible binding to cellular components does not occur. (Authors' Abs.)

656

Jaffe, L. S.
EFFECTS OF PHOTOCHEMICAL AIR POLLUTION ON VEGETATION WITH RELATION TO THE AIR QUALITY REQUIREMENTS. Jour. Air Poll. Control Assoc., v. 17, 38-42, Jan. 1967.

Typical air quality effect levels of photochemical oxidants on specific plant substrates are illustrated [leaf lesions and tissue destruction, retardation of flowering, yield and growth, plant organ injury, and silvering or bronzing of leaves]. These include ambient oxidant exposure data measured as "total oxidant" as well as laboratory exposure to individual pure oxidants, ozone, or PAN [peroxyacetyl nitrates] compounds, since these oxidants are identified in photochemical smog. New terms, "PaNs" [peroxyacyl nitrates] and "PAN-type" oxidant, have been preferred for purposes of clarification of the terminology. PAN-type oxidant more previsely defines the phytotoxicant complex causing silvering or bronzing of the lower leaf surfaces in lieu of the older term "oxidant." Due to the recognition of several oxidizing phytotoxicants in recent years, it is recommended that the term oxidant be reserved for use as a generic term. A tabular classification of the oxidizing phytotoxicants found in community photochemical smog and the specific syndromes produced is provided. (Author's Abs.)

657
Korth, M. W.
EFFECTS OF THE RATIO OF HYDROCARBON TO OXIDES OF NITROGEN IN IRRADIATED AUTO EXHAUST. Cincinnati, Ohio, Public Health Service, National Center for Urban and Industrial Health, Oct. 1966, 59p. (PHS Publ. No. 999-AP-20).

In these auto exhaust studies, the ratio of total hydrocarbon (HC) to oxides of nitrogen (NO_x) was varied between 1 1/2 and 24; hydrocarbon concentrations, from 3 to 12 ppm total carbon; oxides of nitrogen concentrations, from 1/4 to 2 ppm. Greatest plant damage occurred when both the HC/NO_x ratios and hydrocarbon concentrations were high. The levels of eye irritation were highest at the higher chamber hydrocarbon concentrations. For a given hydrocarbon level, chemical reaction rates were highest at the high HC/NO_x ratios. (Public Health Eng. Abs.)

658
Koukol, J., and W. M. Dugger., Jr.
ANTHOCYANIN FORMATION AS RESPONSE TO OZONE AND SMOG TREATMENT IN RUMEX CRISPUS L. Plant Physiol., v. 42: 1023-1024, 1967.

The red coloration which appears on the leaves of dock plants (R. crispus) after exposure to smog or ozone has been shown to be due to the appearance of an anthocyanin. The leaves of untreated plants do not contain detectable anthocyanin. Furthermore, chlorosis does not occur in treated plants. The anthocyanin was isolated from the leaves of smog treated plants, purified, and identified only as a cyanidin glucoside. (Authors' Abs.)

659
Mazelis, M.., N. Beimer, and R. K. Creveling.
CLEAVAGE OF L-CYSTINE BY SOLUBLE ENZYME PREPARATIONS FROM BRASSICA SPECIES. Arch. Biochem. and Biophys., v. 120: 371-378, 1967.

The decomposition of L-cystine to pyruvate and the persulfide, thiocysteine, is catalyzed by soluble enzymes obtained from tissues of Brassica species. The enzyme, called trivally cystine lyase, requires pyridoxal-5'-PO_4 for activity; however, the stimulation of activity by exogenous cofactor is dependent on the species. Partial purification of the enzyme from the root of B. napobrassica (rutabaga) was accomplished. The rutabaga lyase was completely inactive in the absence of added pyridoxal-5'-PO_4. The pH optimum was between 8.5 and 8.9. The lyase was specific for the L-configuration of the amino acid and was only slightly inhibited by equimolar concentrations of the D-form. The K_m for L-cystine was 1mM and was 0.5 μM for pyridoxal-5'-PO_4. There was a severe competitive inhibition by thiol compounds such as cysteine and reduced glutathione. The K_i for both of these compounds was 1.5×10^{-4}M. The enzyme preparation was capable of utilizing S-methyl-L-cysteine sulfoxide and L-cysteine-S-sulfate as substrates. It was completely inactive toward L-cystathionine and DL-allo-cystathionine. The stoichiometry of the reaction was one mole of thiocysteine and one mole of pyruvate produced per mole of pyruvate per mole of cystine. (Authors' Abs.)

660
Middleton, J. T.
AIR POLLUTION THREAT TO FLORA AND FAUNA DOUBLES THREAT TO MAN. Conservation Catalyst, v. 2: 1-3, [1967].

Motor vehicles, manufacturing, electric power generating heating of homes and other buildings, and refuse disposal are the major causes of air pollution. Air pollution is capable of killing and disabling people (emphysema definitely adversely affected by it is the fastest growing cause of death in the U. S.). Agricultural losses alone, from air pollution - including damage to livestock, growing crops, and other plants and trees - are estimated at approximately $500 million a year. The Clean Air Act of 1963 was the first major Federal legislation to control pollution but the problem is getting worse. The Air Quality Act of 1967 is a new approach to controlling air pollution which requires that the Department of Health, Education, and Welfare take several initial steps designed to put control on a more rational, scientific basis before the states begin the work of abatement.

661
Middleton, J. T.
PLANT DAMAGE: AN INDICATOR OF THE PRESENCE AND DISTRIBUTION OF AIR POLLUTION. WHO Bull., v. 34: 477-480, 1966.

Many plant species are inherently sensitive to damage from recognized gaseous air pollutants. Different air pollutants affect different plant species in varying degrees. It is for this reason that there are available a variety of plants which can be used for monitoring a number of air pollutants, not only as to kind but as to concentration.

662
Pack, M. R., and D. F. Adams.
PROBLEMS OF RELATING ATMOSPHERIC ANALYSIS TO EFFECTS OF AIR POLLUTION ON AGRICULTURE. Jour. Air Poll. Control Assoc., v. 16: 219-224, 1966.

Relating of air pollution concentrations to effects on agriculture is hampered by deficiencies in present methods of atmospheric analysis and by inadequate knowledge about how various factors modify the effects. Analytical methods frequently lack sufficient sensitivity or specificity to determine accurately the substances involved. Typical examples include the difficulty of distinguishing among fluoride compounds with widely differing phytotoxic activity, the serious interference from concomitant air pollutants with the usual methods of determining ozone, and the common failure or inability to detect short interval concentration extremes which may cause acute injury. The interrelationship of pollutant concentration and length of exposure in determining plant injury is poorly understood, as are the modifying effects of environmental conditions and age of tissue. The identity of some of the phytotoxic components of the urban photochemical pollution complex is still uncertain, making it difficult to select appropriate analytical methods. Caution should be exercised in using atmospheric analysis data to predict effects of air pollution on agriculture until these deficiencies in analytical methods and understanding of the problem are overcome. (Authors. Abs.)

663
Seidman, G.
EMBEDDING PLANT MATERIAL IN LIQUID SYNTHETIC RESIN. Ohio Jour. Sci., v. 66: 590-591, Nov. 1966.

A process for preserving plant material, which can be done in the field and preserves the natural undulations of the leaf material and the natural colors is described. (Public Health Eng. Abs. Modified)

664
Went, F. W.
FORMATION OF AEROSOL PARTICULATES DERIVED FROM NATURALLY OCCURRING HYDROCARBONS PRODUCED BY PLANTS. Jour. Air Poll. Control Assoc., v. 17: 579-580, Sept. 1967.

The blue hazes, sometimes called summer or heat haze, which hang over vegetated areas all over the world, very much resemble the smog haze. Like smog, the blue appearance of the naturally occurring hazes is due to Tyndall scattering of blue light by submicroscopic particles. Measurements in comparatively unpolluted areas such as Death Valley and Little Valley in Northwestern Nevada have shown that the dilute blue haze is derived from molecularly disperse plant products, mostly terpenes. These terpenes can be measured quantitatively in the air with the aid of a gas chromatograph, and their photochemical transformation into particulate matter can be followed with a condensation nucleus counter. (Air Poll. Abs.)

665
Yu, M. H., and G. W. Miller.
EFFECT OF FLUORIDE ON THE RESPIRATION OF LEAVES FROM HIGHER PLANTS. Plant and Cell Physiology (Tokyo), v. 8: 483-493, 1967.

The effect of F^- on the respiration of leaves from Chenopodium murale and soybean (Glycine max) was studied. Fluoride treatment included both excised leaves cultured in nutrient solutions and leaves from plants fumigated with a HF atmosphere. Tissues treated with low F^- concentrations initially showed increased O consumption but eventually showed decreased O consumption. Tissues treated with a high concentration of F^- showed increased O uptake if analyzed soon after initiation of treatment. The increase in respiration generally took place before visible damage was evident. A decrease in respiration correlated with pronounced injury to the tissues. Besides concentration of F^- and length of treatment, the pH of the culture solution, tissue age, and plant species were important factors affecting respiration. The effect of 2, 4-dinitrophenol (DNP) on respiration was very similar to that of F^- in that the effect differed with pH, concentration, time of treatment, leaf age, and plant species. The respiration of F^- treated leaves was stimulated less by DNP than that of control leaves. (Chem. Abs.)

(a) Crops

666
Chang, C. W., and C. R. Thompson.
EFFECT OF FLUORIDE ON NUCLEIC ACIDS AND GROWTH IN GERMINATING CORN SEEDLING ROOTS. Physiologia Plantarium (Köbenhavn), v. 19:911-918, 1966.

Corn seeds treated with 0.01 M NaF were germinated and grown until the seedling roots reached a standard size of 12 3 mm. Analyses were made for RNA and DNA contents of 3-mm seedling root tips. Determinations also were made for growth rate, rate of cell elongation, cell multiplication, and tissue maturity of whole roots. The RNA contents of the root tips were proportional to the growth rates of the entire seedling root of corn seeds treated with NaF. The RNA content was reduced on a cell basis and was independent of the root tip cell number. The amount of DNA was not related to the growth rate of the intact seedling roots. Since fluoride reduced the number of mitotic figures, fluoride may have inhibited DNA synthesis during the interphase of the mitotic cycle. Growth by cell multiplication was inhibited more than that by cell elongation in the sample treated with fluoride for a shorter period. The two types of growth showed a similar level of growth reduction in the sample treated with fluoride for a longer period. Fluoride reduced the rates of cellular elongation and multiplication by 40% of the control value. Fluoride induced maturity in the seedling roots in proportion to the periods of fluoride treatment. (Biol. Abs.)

667
Chang, C. W. and C. R. Thompson.
STUDY OF PHYTASE AND FLUORIDE EFFECTS IN GERMINATING CORN SEEDS. Cereal Chem., v. 44: 129-142, Mar. 1967.

Some properties of phytase enzyme were studied using the 1700 X g fraction of endosperm-scutellar tissue homogenate of 4-day old corn seedlings. The highest total enzyme activity was located in the fraction at 1700 X g, while the supernatant at 20,000 X g was found to be the location of the highest specific enzyme activity. The enzyme resisted high temperature (up to 50 degrees), was activated by calcium chloride (0.01 M), and was inhibited significantly by sodium fluoride ranging from 10 to 0.05 mM. A rapid decomposition of phytin content was correlated with steady rises of phytase activity and inorganic phosphate in the endospermscutellar tissues of germinating corn seedlings. Fluoride, however, prevented the dephosphorylation of phytin compound in the tissues and retarded the rate of seedling root growth during germination. There occurs continuous turn over between inorganic phosphorus and nucleotides in RNA metabolism. It is assumed that the limited supply of phytinoriginated orthophosphate may be possibly one of the factors, which influences the growth rate of corn seedling roots. (APTIC Abs.)

668
Cheng, J. Y., M. H. Yu, C. W. Miller and others.
FLUOORGANIC ACIDS IN SOYBEAN LEAVES EXPOSED TO FLUORIDE. Environ. Sci. & Technol., v. 2: 367-370, May 1968.

Soybean plants were fumigated with HF or grown in nutrient solution containing sodium fluoride or fluoroacetate, and the organic acid fractions of the leaf extracts were compared. Organic acid extracts from these treatments contained fluoroorganic compounds that were chromatographically similar to fluoroacetate and fluorocitrate. The fractions suspected of containing fluorocitrate were separated from HF-and NaF-treated leaf extracts and found to inhibit aconitase prepared from either pig heart or soybean leaves. The inhibition was similar to that exhibited by commercial fluorocitrate. Aconitase from soybean leaves was as sensitive to fluorocitrate as that isolated from pig heart. Fluorocitrate was identified in extracts of fluoride-treated plants by infrared spectroscopy. (Authors' Abs.)

669
Dean, G. and M. Treshow.
EFFECTS OF FLUORIDE ON THE VIRULENCE OF TOBACCO MOSAIC VIRUS IN VITRO [TESTED ON PHASEOLUS VULGARIS PINTO]. Proc. Utah Acad. Sci. Arts and Letters, v. 42: 236-239, 1966.

Even where close control of variation was maintained under in vitro conditions, results were not completely consistent. On the whole though, the slight stimulation of virus activity at foliar fluoride levels of 200-300 ppm appeared significant. The suppression of lesion development at higher fluoride levels was far more striking and proved to be statistically significant. No attempt was made at this time to explain the mechanism of this action. Since respiration is affected in much the same way, the possible interaction of fluoride effects with the rate of respiration would be a particularly interesting approach to pursue. The main question now is what effects elevated foliar fluoride levels might have on virus activity in whole plants. Now that some of the variables have been reduced, this question is being investigated. (Biol. Abs.)

670
Goppers, V., and H. J. Paulus.
ALLERGENIC COMPOUNDS IN NATURE. International Archives of Allergy and Applied Immunology (Basel), v. 31: 546-550, 1967.

Results of the analysis for compound A on different grain parts, seed plants, and tree and plant pollens are reported. Studies were made of wheat, corn, oats, barley, rye and weeds grown to maturity. The amounts of allergenic compound A were determined after electrophoretic separation of ethanol extracts by means of densitometric scanning of the electrophoresegrams. The amounts found in the stem, husk, bran, and grain of the five grains are given. The maximum densitometric readings ranged from a high of 94 for wheat husk to a low of 4 for rye grain. The readings for the husk and seed of the weeds flax, false flax, rape, and turnip rape ranged from 82 to 95. Readings for pollen were: oak 95; elm 63; short ragweed 96; cotton wood 92; maple 87; and alfafa 38. These finds are discussed. (APTIC Abs.)

671
Jensen, C. R., L. H. Stolzy, and J. Letey.
TRACER STUDIES OF OXYGEN DIFFUSION THROUGH ROOTS OF BARLEY, CORN, AND RICE. Soil Sci., v. 103: 23-29, 1967.

A mathematical theory derived from a simple model of a plant root permits the interpretation of oxygen isotope measurements with intact roots in terms of an apparent longitudinal diffusion coefficient D of O_2 within the root and an apparent permeability h of the root surface for O_2. Application of the theory to the measurements obtained accounts for the differences in tolerance of the 3 species to low aeration of the root medium. The magnitude of D was in the order barley < corn < rice, whereas h was in the order corn > barley > rice. According to the theory, the partial pressure of O_2 within the root as a function of distance down the root is the hyperbolic cosine with an argument decreasing to zero; and the partial pressure of O_2 within the root at its tip as a function of root length is the hyperbolic secant with an increasing argument. The theory is approximate in that it does not explicitly consider respiratory consumption of O_2 within the root. (Authors' Abs.)

672
Katz, M., and L. Ordin.
A CELL WALL POLYSACCHARIDE-HYDROLYZING ENZYME SYSTEM IN AVENA SATIVA L. COLEOPTILES. Biochimica et Biophysica Acta (Amsterdam), v. 141: 126-134, 1967.

Enzymic components catalyzing metabolic degradation of certain cell wall constituents of Avena sativa L. coleoptiles were studied. An enzyme system, bound to crude cell wall preparations and capable of hydrolyzing cell wall polysaccharides, was found. This system consisted of at least two components, one hydrolyzing polysaccharide to oligosaccharide, and the second converting oligosaccharide to monosaccharide. Peroxyacetyl nitrate treatment of tissue in vivo or in vitro resulted in a partially inactivated system. (APTIC Abs.)

673
Katz, M., and L. Ordin.
METABOLIC TURNOVER IN CELL WALL CONSTITUENTS OF AVENA SATIVA COLEOPTILE SECTIONS. Biochimica et Biophysica Acta (Amsterdam), v. 141: 118-125, 1967.

Avena sativa coleoptile sections were incubated in radioactive glucose solution for 3 hrs, and then for various periods of time in unlabeled glucose. The ^{14}C contents of the cell wall fractions and sugar components were measured and metabolic turnover determined. The data indicated that, after transfer to unlabeled medium, ^{14}C was lost from the sugars of the aqueous solution fractions almost immediately but continued to build up in the sugars of the more insoluble fraction. The ^{14}C level in the cellulose remained stable. Coleoptile sections were incubated in glucose ^{14}C with or without auxin. Sugars from various wall fractions were eluted from chromatograms and their amounts determined colorimetrically and by ^{14}C content. Net increase in wall constituents was compared with increase calculated from radioactivity data. Turnover was indicated where the net observed increase was less than the ^{14}C calculated increase. Turnover was clearly indicated in the hexoses of the acid-soluble fractions. No turnover was detected either in cellulose or the alkali soluble fractions. (Chem. Abs.)

674
Krieger, H. L., B. Kahn, and S. Cummings.
DEPOSITION AND UPTAKE OF STRONTIUM-90 AND CESIUM-137 IN AN ESTABLISHED PASTURE. In: Internat. Symposium on Radioecological Concentration Processes, Stockholm, Sweden, 1966. Proceedings. Ed. by B. Aberg and F. P. Hungate. New York. Pergamon Press, 1967, p. 59-72.

The uptake by Kentucky bluegrass of ^{90}Sr and ^{137}Cs from precipitation and soil, contaminated experimentally or by the atmosphere, was measured in the open field and in the lab. The content of ^{90}Sr and ^{137}Cs in the upper 5 cm of field soil averaged 55 and

190 picocuries/mg, respectively, at the beginning and end of the experimental period, whether soil came from covered or uncovered plots. Values fell off to 7 and 52 picocuries/mg, respectively, at a depth of 15-20 cm. Bluegrass grown on this soil and samples throughout the summer contained more of the radioisotopes if grown in the open than if grown under plastic covers. The activity (picocuries/mg dry wt.) of ^{90}Sr and ^{137}Cs in bluegrass from uncovered plots averaged 110-205 and 1600-4300, respectively. Precipitation during this period was 22.5 in., depositing 2930 and 3670 picocuries/m^2 of ^{90}Sr and ^{137}Cs, respectively. Uptake of radioisotope by bluegrass grown to the height of 10 cm in 2-1 pots (25 cm soil depth) varied with the placement of the isotopes (10^5 picocuries). Uptakes were 0.185 and 0.17% of ^{90}Sr and ^{137}Cs, respectively when isotopes were placed on the soil surface. Uptake of ^{90}Sr fell to 0.07-0.10% when the isotope was placed at 2.5-15 cm depth. Cesium-137 uptake was high in the upper 2.5 cm of soil, but fell to 0.01% when Cs was placed at a depth of 15 cm. (Chem. Abs.)

675
Krueger, A. P.
THE EFFECT OF ABNORMALLY LOW CONCENTRATIONS OF AIR IONS ON THE GROWTH OF HORDEUM VULGARIS. Internat. Jour. Biometeorol., v. 9: 201-209, 1965.

A chamber was designed for growing seedlings in a chemically defined medium while maintaining them in air containing about 30^+ and 30^- air ions/cm^3. Air-ion depletion produces a significant reduction in growth of *Hordeum vulgaris* seedlings as measured by integral elongation, fresh weight and dry weight. There is no gross change in chlorophyll production but after 30 days of growth, the plants have very soft leaves and lack normal rigidity. (Author's Abs.)

676
Lee, C. J., G. W. Miller, and G. W. Welkie.
THE EFFECTS OF HYDROGEN FLUORIDE AND WOUNDING ON RESPIRATORY ENZYMES IN SOYBEAN LEAVES. Air and Water Poll., v. 10: 169-181, Mar. 1966.

Soybeans (*Glycine max*, merr, Var. Hawkeye) were cultured in Hoagland's solution and fumigated with hydrogen fluoride (about 100 ppb). After 24, 96 and 144 hr of fumigation, the enzyme activities of cytochrome oxidase, peroxidase, catalase, polyphenol oxidase, ascorbic acid oxidase and glucose-6-phosphate dehydrogenase were assayed in leaves from fumigated and control plants. The total oxygen uptake after each time of treatment was measured. The effect of mechanically wounding the tissue on the above enzymes was determined by rubbing with carborundum. Glucose-6-phosphate dehydrogenase activity from fumigated leaves showed an average increase of 5 to 22 times that of the control. Cytochrome oxidase, peroxidase and catalase activities were markedly stimulated by fluoride fumigation. Polyphenol oxidase activity was suppressed throughout the fumigation period. Ascorbic acid oxidase was stimulated at the initial state, then showed a steady decrease in activity. In vitro tests revealed that ascorbic acid oxidase and peroxidase were very sensitive to fluoride ions. Polyphenol oxidase was only slightly inhibited by 10^{-2} M KF solution. Cytochrome oxidase and catalase were not affected by KF up to 10^{-2}M. Total respiration throughout the treatment period showed an accelerated rate. All enzymes studied were stimulated by wounding. The effect of HF on respiration and specific enzymes is discussed in terms of direct effects and injury. (Authors' Abs.)

677
Leone, I. A., E. Brennan, and R. H. Daines.
EFFECT OF NITROGEN NUTRITION ON THE RESPONSE OF TOBACCO TO OZONE IN THE ATMOSPHERE. Jour. Air Poll. Control Assoc., v. 16: 191-196, Apr. 1966.

Experiments were conducted to determine the effect of nitrogen nutrition on the response of tobacco to ozone in the atmosphere. With Nicotiana rustica L., a noncommercial tobacco, plants receiving an "optimum" nitrogen supply were found to be more susceptible to ozone injury than those receiving deficient or luxury supplies. Furthermore, it was found on analyses of the third oldest tobacco leaf that, while these "optimum" plants showed little or no increase in respiration as a result of ozone in concentrations too low to produce visible injury, plants grown with deficient or excess nitrogen showed a significant increase in respiration under these same conditions. The increase in respiration was accompanied by a comparable and equally significant decrease in carbohydrate content in the latter plants which was not apparent in plants at the "optimum" nitrogen supply, as well as an increase in total nitrogen, protein-nitrogen, and amino-acid nitrogen. In conclusion, it is suggested that the carbohydrate reserve built up in plants grown with deficient nitrogen nutrition serves as protection against the oxidative potential of ozone. Likewise, a decrease in carbohydrate content below that of "optimum" plant provides protection in plants grown with an overabundance of nitrogen fertilization, though possibly by a more complex mechanism. (Authors' Abs.)

678
Lovelace, C. J., G. W. Miller, and G. W. Welkie.
THE ACCUMULATION OF FLUOROACETATE AND FLUOROCITRATE IN FORAGE CROPS COLLECTED NEAR A PHOSPHATE PLANT. Atmos. Environ., v. 2: 187-190, 1968.

Forage crops from a pasture mix which included *Medicago sativa* and *Agropyron cristalum* were collected within 2 mi of a phosphate plant. Horses grazing in this area from plants which contained < 1000 ppm in total fluoride showed severe fluoride injury, although the plants themselves showed no visual injury. The presence of fluoracetate (I) and fluorocitrate (II) was established by chromatographic techniques, inhibition of aconitase, and ir spectral analysis. The concentration of I and II in plants near a high fluoride source was 179 μg/g leaf dry weight respectively, while no detectable organofluoride was found in control plants. Thus, considerable amounts of I and II had accumulated in plants that were exposed to fluoride pollutants, and consumption of these plants could result in adverse effects above those resulting from inorganic fluoride. (Chem. Abs.)

679
Ordin, L., M. J. Garber, B. P. Skoi and others.
ROLE OF AUXIN IN GROWTH OF INHIBITOR-TREATED OAK COLEOPTILE TISSUE. Physiologia Plantarum (Köbenhavn), v. 19: 937-945, 1966.

The role of auxin in the recovery of plant tissue from oxidant treatment was investigated. Treatment of *Avena sativa L.* coleoptile sections with concentrations of IAA or 2, 4-

dichlorophenoxyacetic acid (2, 4-D) optimal for normal growth, following pretreatment with moderately inhibiting levels of peroxyacetyl nitrate immediately accelerated recovery of growth rate. In some cases inhibition was also less at supra-optimal values of auxin. Treatment of ozone-pretreated tissue with IAA or 2, 4-D enhanced inhibition at high levels of auxin and produced an optimal growth concentration level which was lower than for sections not given ozone pretreatment. Auxin treatment also reduced the degree of inhibition in fluoride and iodoacetamide-pretreated sections. Mechanisms by which auxin-induced recovery from inhibition may occur are discussed. (Authors' Abs.)

680
Ordin, L., and M. A. Hall.
CELLULOSE SYNTHESIS BY A CELL-FREE OAK COLEOPTILE ENZYME SYSTEM: INACTIVATION BY AIRBORNE OXIDANTS. Plant Physiol., v. 42: 205-212, 1967.

Particulate cell-wall polysaccharide synthetase from oat coleoptiles utilized GDP-glucose or UDP-glucose (I), the latter being the more effective glucuse donor, in the synthesis of a neutral polymer identified after cellulase digestion as cellobiose. A substance tentatively identified as a mixed-linkage $\beta 1 \rightarrow 4$, $\beta 1 \rightarrow 3$-trisaccharide was also obtained after I utilization. Peroxyacetyl nitrate, and to a lesser extent O_3, inactivated the I-utilizing system, suggesting that the system is a possible site of interference with cellulose and noncellulosic glucan biosynthesis in vivo. Peroxyacetyl nitrate, iodoacetamide, or p-chloromercuribenzoate also inactivated the enzyme upon direct treatment, indicating that the mechanism of inactivation may involve reaction with SH groups. (Chem. Abs.)

681
Ordin, L., M. A. Hall, and M. Katz.
PEROXYACETYL NITRATE-INDUCED INHIBITION OF CELL WALL METABOLISM. Jour. Air Poll. Control Assoc., v. 17: 811-815, 1967.

Levels of peroxyacetyl nitrate(PAN) which inhibit oat coleoptile section growth reversibly, severely inhibit the metabolism of cellulose and of cell wall noncellulosic polysaccharides. An enzyme in the coleoptile cell walls which hydrolyzes some of the noncellulosic glucan was partially inactivated by direct PAN treatment of homogenized cell wall. Treatment of intact cells by PAN also resulted in a partially inactivated enzyme. Coleoptile phosphoglucomutase was partially inactivated by treatment with PAN both in vitro and in vivo. After treatment of intact cells with PAN, phosphoglucomutase associated with subcellular particles was more severely inactivated than was soluble enzyme. Uridine diphosphate glucose pyrophosphorylase from coleoptiles was inactivated by PAN in vitro but not in vivo. A particulate cellulose synthetase from coleoptiles was inactivated by PAN both in vitro and vivo. Since cell wall biosynthesis and (or) degradation are needed for expansion it is concluded that PAN inhibition of these enzymes may account for reduced cell growth. (Chem. Abs.)

682

Treshow, M., G. Dean, and F. M. Harner.
STIMULATION OF TOBACCO MOSAIC VIRUS-INDUCED LESIONS ON BEAN BY FLUORIDE. Phytopathology, v. 57: 756-758, 1967.

The possible effect of F^- on the number of local lesions developing on Pinto bean leaves after inoculation with tobacco mosaic virus was studied. Plants were grown in fumigation chambers in which atmospheric F^- concentration ranged 0.2 - 2.5 $\mu g/m^3$; foliar F^- concentration ranged 20-637 ppm. The number of lesions increased with foliar F^- concentration up to 500 ppm, above which the number decreased. Since the number of lesions that developed varied among fumigations, the lesion numbers were converted to percents of the control. Lesion numbers on plants in the unfumigated chamber served as control and these values represented 100%. The numbers of lesions on leaves with F^- concentration of 100-200, 200-300, and 300-500 ppm were 121, 157, and 179% of the control respectively. The correlation coefficient of 0.802 between F^- concentration up to 300 ppm and lesion numbers was significant at the 1% level. When lesion numbers were grouped according to leaf age, irrespective of F^- concentrations, lesions were most prevalent on the first trifoliolate leaves. The number of lesions diminished on older leaves and on older plants. When leaves were fully developed and plants had reached the 4-5 leaf stage, no lesions could be induced. (Chem. Abs.)

(b) Flowers and Trees

683
Brennan, E., I. A. Leone, and R. H. Daines.
RESPONSE OF PINE TREES TO CHLORINE IN THE ATMOSPHERE. Forest Sci., v. 12: 386-390, 1966.

Three species of pine trees—*Pinus echinata*, *P. elliottii*, and *P. taeda*—were exposed to various time-concentration doses of atmospheric chlorine in an experimental chamber. The needles of all species were visibly injured by a 3-hr fumigation at 1.00 ppm chlorine. As the gas concentration was increased, damage to the needles became more extensive, but there was no tendency toward defoliation. Even when damage encompassed almost the entire complement of needles, the shoot was not killed, as evidenced by the subsequent appearance of new growth. The presence of moisture on the needles during Cl exposures did not intensify the tissue damage as it does during SO_2 and HF fumigations. When pine trees in a hardened condition were exposed to chlorine they were less sensitive than those in an actively growing condition. The Cl content of pine needles generally increased following a Cl fumigation, but the increment was proportional neither to the level of fumigation, nor the extent of damage. (Authors' Abs.)

684
Daines, R. H.
CONTROL OF BACTERIAL SPOT [XANTHOMONAS PRUNI] OF PEACH IN NEW JERSEY. Plant Disease Reporter, v. 51: 349-350, 1967.

In 1965 "Merrill 49er" and in 1966 "Rio-Oso-Gem" peach trees were sprayed from shuck-off to harvest on a 10-day schedule. In these experiments Terramycin and Streptomycin gave superior control of bacterial spot on fruit and foliage alike. When the penetrants DMSO (dimethyl sulfoxide) or glycerol were used with Terramycin rather conspicuous chlorotic spots developed on all but the young leaves. The addition of glycerol to the antibiotics did not improve disease control. (Author's Abs.)

685
Daines, R. H.
EFFECT OF NITROGEN AND CHLORIDE NUTRITION ON SUSCEPTIBILITY AND EFFECT OF FUNGICIDE APPLICATIONS ON CONTROL OF FUSICOCCUM CANKER OF PEACH. Phytopathology, v. 57: 1344-1346, 1967.

Susceptibility of peach trees to infection by F. amygdali was not influenced by three levels of N nutrition. A high chloride level, however, resulted in an increased incidence of nodal cankers. Of the many fungicides tested, only the organo mercurials (methylmercury 8-hydroxyquinolinate and methylmercurididicyandiamide), used on a 10- or 20-day schedule, or Bordeaux mixture-lead arsenate, used on a 10-day schedule during the leaf-dropping period, provided highly significant protection against leaf scar infections. In the spring, one application of Bordeaux mixture-lead arsenate during the late dormant period and a second application during the delayed dormant period provided highly significant protection against infections occurring through damaged buds and bud scale scars. (Chem. Abs.)

686
Hanover, J. W.
INHERITANCE OF 3-CARENE CONCENTRATION IN PINUS MONTICOLA. Forest Sci., v. 12: 447-450, 1966.

Concentration of the monoterpene 3-carene in cortex oleoresin of Pinus monticola Douglas appears to be controlled primarily by single dominant and recessive alleles at a locus designated C/c. Some trees completely lack 3-carene, which indicates that an inhibitor may determine the presence or absence of this monoterpene in white pine. (Author's Abs.)

687
Hibben, C. R., and H. T. Walker.
A LEAF ROLL-NECROSIS COMPLEX OF LILACS IN AN URBAN ENVIRONMENT. Proc. Amer. Soc. Horticultural Sci., v. 89: 636-642, 1966.

Lilacs (Syringa vulgaris) in the metropolitan New York area have a foliar disorder characterized by leaf roll, interveinal and marginal necrosis, chlorosis, bronzing, and early leaf abscission that is sometimes followed by a break in dormancy of terminal buds. Soil and leaf analyses and fertilization experiments revealed no nutrient deficiencies or toxicities. Arthropod infestations were not implicated, although injury by the eriphyid mite, Aculus massalongoi sometimes augmented the disorder. Foliar and root plant pathogens were investigated and discounted as primary causal agents. The inducement of symptoms on healthy lilacs transferred to an urban environment, and the recovery of clones from symptomatic lilacs when the clones were removed to a rural environment were considered evidence that an atmospheric factor was involved. Leaf roll-necrosis symptoms developed on lilacs exposed in chambers to controlled flow rates of urban air, providing additional evidence that an air pollutant was causing or contributing to the disorder. The urban air contained sufficient ozone concentrations to crack ozone-sensitive rubber strips. (Authors' Abs.)

688
Leonard, C. D.
DIMETHYL SULFOXIDE AS A CARRIER FOR IRON IN NUTRITIONAL FOLIAR SPRAYS APPLIED TO CITRUS. Ann. New York Acad. Sci., v. 141: 148-158, 1967.

Iron sulfate (275-1300 ppm Fe), $Fe(NO_3)_3$ (725-1000 ppm Fe), ferric ammonium citrate (260-780 ppm Fe), monosodium H ferric diethylenetriaminepentaacetate (315-525 ppm Fe), Na ferric ethylenediaminedi(o-hydroxyphenyl)acetate (I) (40-640 ppm Fe), Fe ethylenediaminetetraacetate (315-525 ppm Fe), and Chelatex-Fe (a natural organic metal-complexing agent from hemlock bark) (500-1600 ppm Fe) were applied as foliar sprays or dips to b branches of severely Fe-deficient orange and grapefruit trees grown on alkaline calcareous soil with or without 2% dimethyl sulfoxide (II). In general, Fe solutions containing 2% II resulted in a faster and more uniform greening of Fe-chlorotic leaves and higher chlorophyll in leaves than similar solutions without II. Chelatex-Fe at 1000 ppm with urea and 2% II gave the most uniform greening from foliar treatments applied during the fall and winter. Two dips of Chelatex-Fe gave considerably faster greening of Fe chlorotic leaves than did one dip. Soil treatment of Fe-chlorotic trees with 30 g of Fe/tree as I completely greened 65-80% of the leaves on the trees in 5 mo. Foliar application of any of the Fe sprays to whole trees often caused defoliation. Although foliar treatment, particularly those with Chelatex-Fe, gave more rapid greening of Fe-chlorotic leaves than soil treatments with I, they did not prevent development of Fe-chlorotic leaves in the next flush of growth, whereas soil treatments were often effective for nearly one year. (Chem. Abs.)

689
Leonard, C. D., and H. B. Graves, Jr.
EFFECT OF AIR-BORNE FLUORIDES ON VALENCIA ORANGE YIELDS. Proc. Fla. State Horticultural Soc., v. 79: 79-86, 1966.

Citrus groves near phosphate plants in central Florida tend to show a gradual and relatively consistent buildup in leaf fluorides during their growth and development in spite of wind changes which cause considerable daily variations in the concentrations of air-borne fluorides. A field experiment with bearing Valencia orange trees on rough lemon rootstock was made to study the effects of different levels of air-borne fluorides on yield, fruit quality, and leaf growth. The experimental trees were in a grove exposed to relatively high levels of air-borne fluorides. Six trees were enclosed in individual plastic greenhouses. Fluorides were removed from the air entering 3 greenhouses by dry $CaCO_3$ filters, while unfiltered ambient air was moved through the other 3 greenhouses. Three additional trees were not enclosed and were used as outdoor checks. The leaves of trees in the unfiltered greenhouses absorbed much less fluorine than those of the outdoor checks, even though there was little difference in the fluorine content of the air. This probably occurred because the leaves were kept dry inside the greenhouses. Greenhouse trees receiving unfiltered air produced significantly less fruit in 1965-66 than those receiving filtered air, and the outdoor check trees yielded significantly less fruit than the unfiltered greenhouse trees. Leaf size decreased as leaf fluorine increased. There was a trend toward a higher acid level and a lower Brix: acid ratio of the juice with increasing fluorine in the leaves, but these differences were not significant. (Chem. Abs.)

690
Linzon, S. N.
DAMAGE TO EASTERN WHITE PINE BY SULFUR DIOXIDE, SEMIMATURE-TISSUE NEEDLE BLIGHT, AND OZONE. Jour. Air Poll. Control Assoc., v. 16: 140-144, 1966.

Eastern white pine (Pinus strobus L.) forests were severely damaged by atmospheric sulfur dioxide up to distances of 25 miles northeast of large smelters located in the Sudbury mining district of Ontario. Damage to white pine was measured in terms of foliage, bark, and biological injuries, radial and volume growth decrement, and tree mortality. The foliar symptoms of sulfur dioxide injury on white pine trees sometimes resembles those caused by physiogenic disease, semimature-tissue needle blight (abbreviated to SNB). Studies on the nature and etiology of SNB were conducted in white pine forests in the Upper Ottawa Valley, which are remote from smelter operations which might pollute the atmosphere. These studies included the determination of the role that naturally-occurring atmospheric ozone plays in the occurrence of SNB. Differences between the symptoms of sulfur dioxide injury, SNB, and ozone damage are outlined. (Author's Abs.)

691
McCune, D. C., A. E. Hitchcock, and L. H. Weinstein.
EFFECT OF MINERAL NUTRITION ON THE GROWTH AND SENSITIVITY OF GLADIOLUS TO HYDROGEN FLUORIDE. Contrib. Boyce Thompson Inst., v. 23: 295-299, 1966.

'Snow Princess' and 'Elizabeth the Queen' varieties of gladiolus were grown in sand culture on a complete (Hoagland's) nutrient solution and solutions deficient in K, Ca, Mg, P, N, Mn, or Fe. After 6 or 7 weekly hydrogen fluoride (HF) fumigations at 2.1 μg F/m^3 for 24 hr, the plants were harvested and the growth, fluoride (F) level, and tip burn of the foliage were determined. No effect of nutrient level on the F level of the foliage was found, but increased tip burn was associated with K and P deficiency in 'Snow Princess' and Mg deficiency in 'Elizabeth the Queen'. Decreased tip burn was associated with Ca and N deficiencies in 'Snow Princess,' and no effect of Fe or Mn deficiency on tip burn was found in either variety. (Authors' Abs.)

692

MacLean, D. C., D. C. McCune, L. H. Weinstein, and others.
EFFECTS OF ACUTE HYDROGEN FLUORIDE AND NITROGEN DIOXIDE EXPOSURES ON CITRUS AND ORNAMENTAL PLANTS OF CENTRAL FLORIDA. Environ. Sci. & Technol., v. 2: 444-449, 1968.

Six citrus varieties and 6 ornamental species of economic importance to central Florida were subjected to high concentration-short duration exposures of gaseous HF or NO_2. Postfumigation observations showed that the effects of acute pollutant exposures differ markedly from those of chronic exposures. Hydrogen fluoride exposures of 0.5 to 10 ppm for periods from 0.5 to 8 hrs induced tip, marginal, and intercostal chlorisis and necrosis, and abscission of leaves of most plants tested. Symptoms were most severe on, but not limited to, young leaves. The effect of duration of exposure had a greater influence on abscission of young citrus leaves than did HF concentration. However, the effect of HF concentration on foliar F accumulation could not be separated from exposure time. The NO_2 concentrations used ranged from 25 to 250 ppm for periods of from 10 min to 8 hrs. Nitrogen dioxide damage was characterized by rapid tissue collapse, necrosis, and defoliation. Symptoms were sporadic in appearance, affecting leaves of all ages. The relative contributions of concentration and duration to NO_2-induced injury were about equal. (Chem. Abs.)

693

Pady, S. M., C. L. Kramer, and R. Clary.
DIURNAL PERIODICITY IN AIRBORNE FUNGI IN AN ORCHARD. Jour. Allergy, v. 39: 302-310, May 1967.

Four Kramer-Collins spore samplers were operated continuously in a small apple orchard, from July 26 to 30, 1965. Numbers of the common spore types, hyphal fragments, and pollen were determined per cubic foot. Rains occurred on July 27 and 28. The precipitation removed Cladosporium and Alternaria from the air, caused spores of puffballs to be dispersed immediately, and stimulated the discharge of ascospores and basidiospores. Following the rains, conditions were favorable for sporulation and a diurnal pattern became evident. Cladosporium, Alternaria, Cercospora, Helminthosporium and hyphal fragments had daytime peaks, while ascospores of Sordaria and Hypoxylon and basidiospores of Coprinus and Sporobolomyces had distinct night-time peaks. Pollen grains of Acalypha ostryaefolia had peaks between 6 and 7 A. M. on 4 successive days following the rain. (Authors' Abs.)

694
Thompson, C. R., O. C. Taylor, M. D. Thomas, and others.
EFFECTS OF AIR POLLUTANTS ON APPARENT PHOTOSYNTHESIS AND WATER USE BY CITRUS TREES. Environ. Sci. & Technol., v. 1: 644-650, Aug. 1967.

Because of the major damage to crops by air pollutants, studies were begun to measure under field conditions, the effect of various atmospheric phytotoxicants on agricultural crops in the Upper Santa Ana Drainage Basin. There was question as to whether photochemical smog and/or fluorides were responsible for major economic losses by the citric industry and if so, how much. Commercially producing lemon and navel orange trees were tested to determine the effects of ambient air pollutants which occur in the Los Angeles basin on water use (transpiration) and apparent photosynthesis. The entire trees were enclosed in plastic covered greenhouses and were supplied various fractions of the atmosphere to find whether ozone, peroxyacyl nitrates, or fluorides were causing deleterious effects. Nitric oxide was added to the air in one treatment to reduce ozone selectively but in so doing, NO_2 in amounts equal to the ozone was formed. The results showed that the total photochemical smog complex reduced the rate of water use by lemon trees and also reduced the rate of apparent photosynthesis. Fluoride levels occurring in the atmosphere caused no detectable effects. Attempts to evaluate the separate effects of ozone and peroxyacyl nitrates were unsuccessful. Reduction of the ozone in the tree atmospheres by addition of nitric oxide failed to overcome the reduced water use and lowered apparent photosynthesis. (APTIC Abs.)

695
Treshow, M., F. K. Anderson, and F. Harner.
RESPONSES OF DOUGLAS FIR TO ELEVATED ATMOSPHERIC FLUORIDES. Forest Sci., v. 13: 114-120, 1967.

Pseudotsuga menziesii averaging 69 yrs were examined beyond the zone of complete kill in the vicinity of a phosphate reduction plant emitting fluorides into the atmosphere. The plant was in operation for only 4 yrs so annual rings could be measured to determine radial growth before, during, and after exposure to atmospheric pollution. During plant operation, increasing fluoride content in needles was inversely correlated with radial growth, even when needles showed no visible injury (below 200 ppm). There was no change in radial growth in trees accumulating less than 50 ppm in their needles. Trees with low levels of fluoride in their needles had longer needles and branches. (Chem. Abs.)

(c) Vegetables

696
Altman, J., and M. Ross.
PLANT PATHOGENS AS A POSSIBLE FACTOR IN UNEXPECTED PREPLANT HERBICIDE DAMAGE IN SUGAR BEETS. Plant Disease Reporter, v. 51: 86-88, 1967.

Pebulate plus Rhizoctonia in the soil resulted in more rapid damping-off sugar beet seedlings than when Rhizoctonia alone was present. The effect of pebulate on the host or pathogen is unknown. The possibility exists that the herbicides affected the host plant physiologically in such a way that the seedlings remained in a juvenile state for weeks rather than days thereby being more susceptible to damping-off and to nematode damage. An alternative possibility is that increased parasite vigor might be brought about by herbicides. (Chem. Abs.)

697
Applegate, H. G.
PESTICIDES AT PRESIDIO. II. VEGETATION. Texas Jour. Sci., v. 18: 266-271, 1966.

Data are presented on the concentrations of DDT and phosphorylated pesticides in cotton (Gossypium hirsutum L.) and leatherstem (Jatropha dioica var. dioica Sesse ex Cerv.) at Presidio, Texas. Pesticides could be detected in the leaves prior to their first application in the summer. Leatherstem apparently can accumulate the phosphorylated pesticides. (Biol. Abs.)

698
Bandt, C. S., and W. W. Heck.
EFFECTS OF AIR POLLUTANTS ON VEGETATION. In: Air Pollution. v. I. Air Pollution and its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 401-443.

The general types of injury to vegetation by air pollution and a summary of the injury patterns are presented. Many factors affect the response of vegetation to air pollutants such as genetic factors, time-concentration relations, and environmental and growth factors. Plants are used as monitors of air pollution and are often the initial indicators of an air pollution problem. Monitoring programs included field surveys, bioassay of ambient pollution and the bioassay of pollutant mixtures produced under laboratory conditions. The economics of injury versus plant damage are discussed and the general problems of such an evaluation described. Little has been done about means of reducing injury to vegetation from polluted air. Breeding programs, cultural and management practices, land use, and air quality control are discussed.

699
Cole, A. F. W., and M. Katz.
SUMMER OZONE CONCENTRATIONS IN SOUTHERN ONTARIO IN RELATION TO PHOTOCHEMICAL ASPECTS AND VEGETATION DAMAGE. Jour. Air Poll. Control Assoc., v. 16: 201-206, Apr. 1966.

In the summers of 1960 and 1961, groups from the Canada Department of Agriculture, the Meteorological Service of Canada, and the Canada Department of National Health and Welfare conducted a joint study in a tobacco-growing area along the north shore of Lake Erie. The purpose of the study was to determine the causal agent for weather fleck damage to tobacco crops. A number of air pollutants were monitored and the results correlated with extensive observations of meteorological phenomena and effects on rate of growth and fleck damage to leaves of tobacco plants in experimental plots. Ozone concentrations followed a diurnal cycle, rising a few hours after sunrise, peaking in early afternoon at about 5 pphm, and dropping to a minimum of less than 1 pphm during the night. Other measurements indicated the presence of NO_2 in the order of 1 pphm, aldehydes about 0.2 pphm or lower, and negligible concentrations of SO_2. Cracking of stretched rubber strips followed the ozone values although, in general, the cracking index was greater than could be attributed to ozone (by oxidized KI) alone. The maximum ozone value recorded during the two growing seasons was 15 pphm. A dosage of 20 pphm hr was found sufficient to cause weather fleck or ozone damage to susceptible tobacco leaves. In addition meteorological data could be used to predict weather fleck attacks one to four days in advance. (Authors' Abs.)

700
Darley, E. F.
STUDIES OF THE EFFECT OF CEMENT-KILN DUST ON VEGETATION. Jour. Air Poll. Control Assoc., v. 16: 145-150, 1966.

Most of the recent work on the effects of cement-kiln dust has been confined to Germany and results differ considerably. There appears to be little doubt that naturally deposited dust from certain cement plants is responsible for leaf injury to deciduous and coniferous species and occasionally for death of the latter. Injury results from the combination of a relatively thick crust deposit and the toxicity of alkaline solutions formed when dusts are deposited in the presence of free moisture. The results of several hand-dusted field experiments, however, are not so conclusive; dusts are reported as either harmful, harmless, or even indirectly beneficial. In the present laboratory investigation [bean plants], the comparison of CO_2 exchange in the leaf between dusted and nondusted leaves, as well as occurrence of obvious tissue damage, were used as a criteria of dust effects in short term experiments. The results demonstrated that the finer particles of certain cement-kiln dusts collected from electrostatic precipitators do interfere with CO_2 exchange and in some cases cause considerable leaf injury. The results further suggest that calcium content alone may not be the only indicator of whether a dust might be injurious, and that much more needs to be known about the effects of the interaction of chemical composition, particle size, and deposition rate. (Author's Abs.)

701
Darley, E. F., Oshima, R. J., and S. Lerman.
ROLE OF PARTICLE SIZE IN STUDIES ON EFFECT OF DUSTS ON VEGETATION. Jour. Air Poll. Control Assoc., v. 17: 579, Sept. 1967.

One objective of an air pollution project to determine the effect of settleable industrial dusts on vegetation is to elucidate the effect of particle size. Previous work has shown that the chemical composition of certain cement-kiln dusts varies radically with particle size; in one such dust, most of the KCl present was found on particles of less than 10 μ. In trying to relate laboratory results, with what might occur in the field, it becomes important to know the sizes of dusts that are actually falling on vegetation at considerable distances from a source where deposits become visible during the growing season. In preliminary field tests, sheets of plastic were exposed about 0.75 mi downwind from a source. After 4 hr a visible layer of dust was deposited on the plastic but the dust could not be removed for subsequent analysis on a Coulter counter. Large glass plates, 4 ft^2, were substituted for the plastic. It was found that six of these were sufficient to catch enough dust to permit size analysis on a Coulter counter and chemical composition by X-ray diffraction and atomic absorption techniques. (Air Poll. Abs.)

702
Heck, W., and J. A. Dunning.
THE EFFECTS OF OZONE ON TOBACCO AND PINTO BEAN AS CONDITIONED BY SEVERAL ECOLOGICAL FACTORS. Jour. Air Poll. Control Assoc., v. 17: 112-114, Feb. 1967.

Environmental factors have a determining influence on the sensitivity of plants to ozone as an air pollutant. The effect of several environmental and related factors has been reported as preliminary to a further study of multiple factor interactions and eventual application to field conditions. Plants grown under a short photoperiod and low light intensity are more sensitive to ozone than those grown under a long photoperiod and a high light intensity. The sensitivity of tobacco or pinto bean to ozone, as an air pollutant, is increased by growing plants in a shortened photoperiod under reduced light intensity and in a light potting mix. Sensitivity also is influenced by CO concentration, time of day and age of plant at time of exposure. Tobacco shows cumulative development of injury when exposed to low concentration intermittently over several days. (APCA Abs.)

703
Hindawi, I. J.
INJURY BY SULFUR DIOXIDE, HYDROGEN FLUORIDE, AND CHLORINE AS OBSERVED AND REFLECTED ON VEGETATION IN THE FIELD. Jour. Air Poll. Control Assoc., v. 18: 307-312, May 1968.

Plants were examined at three different locations in the eastern part of the United States to determine whether damage from air pollution had occurred. This paper discusses SO_2 damage in the metropolitan New York City area; HF damage near a glass fiber manufacturing plant in the midwest; and HCl mist and Cl damage from a manufacturing operation in an eastern state. The symptoms that developed in vegetation were often found to be similar. Chemical and microscopical analyses were helpful in diagnosing the toxicants. (Author's Abs.)

704
Mohamed, A. H.
CYTOGENETIC EFFECTS OF HYDROGEN FLUORIDE TREATMENT IN TOMATO PLANTS. Jour. Air Poll. Control Assoc., v. 18: 395-398, June 1968.

Seeds from tomato plants fumigated with HF gas of a concentration of about 3 Mg/m^3 were planted in pots in the greenhouse. A number of plants in each culture were found to be developing abnormally. These abnormalities consisted of one, three, or four cotyledons; deformed cotyledons; plumuless seedlings; fasciated petioles; wiry seedlings, double stalked plants; and dwarf seedlings. Such abnormal phenotypes were the same as, or similar to, known mutants. There was a trend toward a higher percentage of total phenotypic abnormalities with an increase in the treatment duration. Meiotic analyses of the C_1 generation (offspring of the fumigated plants, C_0) showed the occurrence of fragments or bridges plus fragments. There was also a trend toward a higher percentage of chromosomal aberrations with an increase in the treatment duration except for the 4 days duration which was higher than most of the other treatments. It is believed that the occurrence of these aberrations was due to the crossing over in heterozygous paracentric inversions. These results suggest that HF is a mutagenic agent probably blocking directly or indirectly the replication of the DNA. (Author's Abs.)

705
Mohamed, A. H., H. G. Applegate, and J. D. Smith.
CYTOLOGICAL REACTIONS INDUCED BY SODIUM FLUORIDE IN ALLIUM CEPA ROOT TIP CHROMOSOMES. Canadian Journal of Genetics and Cytology (Ottawa), v. 8: 241-244, 1966.

Onion root tips were treated with NaF solution of $1 \times 10^{-2}M$. Treatment periods ranged from 2 to 18 hr with 2 hr increments and from 24 hr to 48 with 6 hr increments; a treatment of 60 hr was also conducted. Cytological analyses of root tip chromosomes indicated a positive correlation between frequency of chromosomal aberrations and treatment duration. Some root tip cells had only a single bridge; others had 2 or more. Fragments without the formation of chromosomal bridges were frequent in all the treatments. The formation of anaphase bridges resulted from the development of dicentric chromosomes. Tetraploid nuclei and multipolar anaphases were also observed. (Biol. Abs.)

706
Mohamed, A. H., J. D. Smith, and H. G. Applegate.
CYTOLOGICAL EFFECTS OF HYDROGEN FLUORIDE ON TOMATO CHROMOSOMES. Canadian Journal of Genetics and Cytology (Ottowa), v. 8: 575-583, 1966.

Pre-flowering plants of a highly inbred tomato line were fumigated in growth chambers with HF at a concentration of about 3 μg/m^3. This concentration was too low to induce visible injury up to 11 days of continuous fumigation. The experiment was run for 12 days with the first cytological sample taken after 4 days and then at increments of two days. After each period of treatment the fumigated and the control plants were removed to the greenhouse for recovery. Young leaf and flower bud smears for the treatments and the recoveries were scored for anaphase aberrations. Chromosomal aberrations found included bridges, fragments, and bridges plus fragments. All these aberrations were observed in mitosis and meiosis of the treated plants. There was a trend toward a higher percentage of chromosomal aberrations with an increase in the treatment period. In the recovery, leaf smears showed no detectable chromosomal aberrations. However, pollen mother cells showed the presence of fragments and/or bridges plus fragments ments but no bridges by themselves. These could be due to crossing over in heterozygous paracentric inversions. The obtained results suggest that HF may be a mutagenic agent. (Authors' Abs.)

707
Pack, M. R.
INFLUENCE OF HYDROGEN FLUORIDE FUMIGATION ON ACID-SOLUBLE PHOSPHORUS COMPOUNDS IN BEAN SEEDLINGS. Environ. Sci. & Technol., v. 1: 1011-1013, Dec. 1967. (Presented at: 153rd Meeting, Amer. Chem. Soc., Div. Water, Air, and Waste Chem., Miami Beach, Fla., Apr. 1967).

Bean seedlings were grown for four days following emergence in an atmosphere containing hydrogen fluoride (HF) at 14 μg of fluorine per m^3. Their acid-soluble phosphorus composition was compared with that of seedlings grown in a decontaminated atmosphere. The seedlings in the HF treatment accumulated 275 ppm of F but showed no symptoms of injury. The phosphorus compounds were extracted with 0.6N trichloroacetic acid and separated on an anion exchange resin column by elution with a variable gradient of formic acid and ammonium formate. There were no apparent differences between the atmospheric treatments with respect to the approximately 20 phosphorus compounds in the plant extracts. These results suggest that under some conditions plants can tolerate appreciable fluoride without significant inhibition of enzymes that catalyze reactions of phosphorus compounds. (Author's Abs.)

708
Pack, M. R.
RESPONSE OF TOMATO FRUITING TO HYDROGEN FLUORIDE AS INFLUENCED BY CALCIUM NUTRITION. Jour. Air Poll. Control Assoc., v. 16: 541-544, 1966.

Two varieties of tomatoes grown at 40 to 200 ppm calcium [Ca] were continuously fumigated with HF [hydrogen fluoride] throughout flowering and fruit development. Fruit size was directly related to the level of Ca nutrition, and within each Ca treatment the fruits on plants subjected to HF at about 6 μg F/m^3 were smaller than those on unfumigated plants. The smaller fruit size was associated with partial or complete seedlessness, suggesting that Ca plays an essential role in fertilization with which fluoride may interfere. Fluoride injury to the tomato foliage was most severe at the lowest Ca level. Treatment with HF at about 3 μg F/m^3 produced some injury to tomato foliage but had no apparent effect on fruiting. Evidently fluoride can affect plant fruiting, but considering the severity of the HF treatments required, effects on tomato fruiting probably are of little practical significance. The relationship between fluoride injury and Ca nutrition suggests interference with Ca metabolism as a mechanism of fluoride injury to plants. (Author's Abs.)

709
Thomson, W. W., W. M. Dugger, Jr., and R. L. Palmer.
EFFECTS OF OZONE ON THE FINE STRUCTURE OF THE PALISADE PARENCHYMA CELLS OF BEAN LEAVES. Canadian Journal of Botany (Ottawa), v. 44: 1677-1682, 1966.

The effects of ozone on the fine structure of palisade parenchyma cells were of 2 phases. The 1st phase involved changes in the chloroplast stroma which consisted of either a granulation and an increase in electron density or a formation of ordered arrays of granules and fibrils. In the 2nd phase, there was a general disruption of the cellular membranes and organelles, and the cellular contents aggregated in the center of the cells. The characteristic components of this aggregate were remains of the chloroplast membrane system and numerous ordered arrays of granules and fibrils. These changes were identical with those previously observed in cells damaged by peroxyacetyl nitrate and were probably related to oxidation properties of both molecules. In some cells there was a disruption of the organization of the grana within the chloroplasts. (Chem. Abs.)

710
Tishel, M., and M. Mazelis.
THE ACCUMULATION OF SUGARS IN POTATO TUBERS AT LOW TEMPERATURES AND SOME ASSOCIATED ENZYMATIC ACTIVITIES. Phytochemistry, v. 5: 895-902, 1966.

A comparison was made of the activities of several enzymes involved in sugar transformations in potatoes stored both at low temperature and at room temperature. Whole tubers were used, and a technique comparing halves of the same potato was developed. The potato halves and the whole tubers showed similar patterns except the halves went through the pattern more rapidly. The enzymes studied were phosphohexose isomerase, glucose-6-phosphate dehydrogenase, aldolase, and invertase. Within 4 days sucrose accumulated in the potato halves at low temperature followed by increases in reducing sugars. The results could not be explained by a simple lowering of respiration rate at low temperatures. A probable sequence of events appears to be that low temperature induces in the tuber a temporary decrease in aldolase activity, an increase in sucrose, increased invertase activity, accumulation of reducing sugars, followed by a lowering of the activity of phosphohexose isomerase. (Authors' Abs.)

711
Tomlinson, H., and S. Rich.
METABOLIC CHANGES IN FREE AMINO ACIDS OF BEAN LEAVES EXPOSED TO OZONE. Phytopathology, v. 57: 972-974, 1967.

Leaves of bean, tobacco, beet, corn, barley, or rye that are visibly damaged by O_3 accumulate free amino acids. Shorter periods of ozonation which do not cause visible damage produce specific increases in γ-aminobutyric acid and alanine and decreases in glutamic acid levels. The pattern of amino acid labeling and fixation of $^{14}CO_2$ by ozonated bean plants suggests a complex process of enhanced decarboxylation of glutamic acid and inhibited photosynthesis and protein synthesis. These effects could result from the oxidation of essential SH groups and increased membrane permeability. (Chem. Abs.)

712
Welkie, G. W., S. F. Yang, and G. W. Miller.
METABOLITE CHANGES INDUCED BY CUCUMBER MOSAIC VIRUS IN RESISTANT AND SUSCEPTIBLE STRAINS OF COWPEA. Phytopathology, v. 57: 472-475, 1967.

Cucumber mosaic virus infection of both resistant (local lesion) and susceptible strains of cowpea (*Vigna sinensis*) resulted in an increase of most of the amino acids, especially asparagine, that were recovered two days after inoculation. Pipecolic acid was found only in the infected resistant strain of cowpea. Exposure of plants to $^{14}CO_2$ for 4 hr prior to harvest resulted in an increased labeling of the amino acid and organic acid fractions of the infected tissue. Most of the radioactivity in the amino acid fraction was detected in aspartic acid, except for traces of asparagine in the infected tissue. Radioactivity of malic and malonic acids was greater in the infected tissue of resistant and susceptible strains, whereas an increase in labeled citric acid occurred only in the infected tissues of the susceptible strain. Phosphoenolpyruvate carboxylase activity increased 40 and 60% in infected resistant and infected susceptible strains of cowpea, respectively. An accelerated dark CO_2 fixation can partly account for the increase of some organic acids, amino acids, and amides in infected plants. (Chem. Abs.)

VIII. MATERIALS DETERIORATION

713
Ajax, R. L., C. J. Conlee, and J. B. Upham.
THE EFFECTS OF AIR POLLUTION ON THE FADING OF DYED FABRICS. Jour. Air Poll. Control Assoc., v. 17: 220-224, Apr. 1967.

This report details results for the first six months of a two-year study begun in February 1965 by The American Association of Textile Chemists and Colorists and the Public Health Service to evaluate the effects of air pollution upon dyed fabrics. Groups of 69 dye-fabric combinations representing widely used dyes were exposed to light-free cabinets to ambient environments at urban and rural sites in Chicago, Washington, D. C., Tacoma, and Los Angeles, and at urban sites in Cincinnati, Phoenix, and Sarasota. Preliminary results of consecutive three-month seasonal exposures and controlled-environment exposures to irradiated and nonirradiated automobile exhaust for short durations show extreme fading of one-fourth of the dyed-fabrics, a higher degree of fading of susceptible fabrics at urban sites compared with that at rural sites, and a marked effect of photochemical by-products of automobile exhaust upon dyed fabrics. (Authors' Abs.)

714
Brysson, R. J., B. J. Trask, and A. S. Cooper, Jr.
THE DURABILITY OF COTTON TEXTILES. THE EFFECTS OF EXPOSURE IN CONTAMINATED ATMOSPHERES. Amer. Dyestuff Reporter, v. 57: 15(512)-20(517), July 1968

The durability of exposed cotton textiles is influenced by the ambient air quality as well as the aggregate effect of sunlight, humidity, and micro-organisms. This report describes the exposure of cotton fabrics at sites of widely varying atmospheric contamination and paralleling laboratory studies with artificially contaminated fabrics. The outdoor exposure sites ranged from heavy industrial (high contamination) to essentially rural (low contamination). The laboratory studies included artificial contamination of fabric samples and exposure to ultraviolet and visible light. The data include strength retention, degree of soiling, selected sample pH measurements, and cellulose fluidities together with air contamination data as determined by periodic measurements of dustfall, suspended particulate matter and SO_2 content. The outdoor data definitely establish a relationship between atmospheric contamination and accelerated degradation of cotton fabrics. The laboratory data indicate the role of light in accelerating the degradation of contaminated cotton fabrics. (Authors' Abs.)

715
Brysson, R. J., B. J. Trask, J. B. Upham, and others.
THE EFFECTS OF AIR POLLUTION ON EXPOSED COTTON FABRICS. Jour. Air Poll. Control Assoc., v. 17: 294-298, 1967.

This report covers the results of one-year exposure studies of cotton fabrics exposed at different environmental sites in the metropolitan St. Louis, Mo., and Chicago, Ill. areas. The 12 sites range from heavily industrial to essentially rural. The data presented definitely establish a relationship between air pollution and accelerated degradation of cotton fabrics. The data include strength retention of several cotton fabrics and air pollution data, as determined by periodic measurement of dustfall, suspended particulate matter, sulfation, and SO_2. (Authors' Abs.)

716
Harding, C. I.
SULFATION AND CORROSION MEASUREMENTS IN A MARINE COASTAL CITY OF FLORIDA. In: Proc. Internat. Conf. Atmospheric Emissions from Sulfate Pulping, Sanibel Island, April 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n.d., p. 354-357.

The measurements of corrosion rates and sulfation rates in a marine coastal city in Florida are presented and discussed with reference to a sulfuric acid plant operating in the area.

717
Harding, C. I., and T. R. Kelley.
HORIZONTAL AND VERTICAL DISTRIBUTION OF CORROSION RATES IN AN INDUSTRIALIZED SEACOAST CITY. Jour. Air Poll. Control Assoc., v. 17: 545-547, Aug. 1967.

The use of 3 x 4 in. mild carbon steel plates in a 44-station network over the entire metropolitan Jacksonville area has demonstrated monthly corrosion patterns effectively. A 1000 high T. V. tower has been outfitted with corrosion plates at 100 intervals. These data were used to give a good description of SO_2 dispersion from the several major sources nearby. The corrosion rate, expressed in $mg/cm^2/30$-day mo, was determined by the weight-loss method. The oxide layer was removed by acid cleaning prior to each weighing. The corrosion study was extended to the Jacksonville Beach area approximately 15 mi from the center of the city to conclusively show that the high corrosion rate in the Jacksonville area was the result of air pollutants and not the salt content of the St. John's River estuary which bisects Jacksonville. (Authors' Abs.)

718
Jaffe, L. S.
THE EFFECTS OF PHOTOCHEMICAL OXIDANTS ON MATERIALS. Jour. Air Poll. Control Assoc., v. 17: 375-378, June 1967.

The excessive cracking of rubber products was one of the earliest indicators of the presence of atmospheric photochemical oxidants. It has been demonstrated that this excessive cracking of rubber is caused by atmospheric ozone formed in the photochemical smog formation process. Depending on the formulation of the rubber, cracking under stress can readily be detected within 3/4 hr when atmospheric oxidant levels are as low as 0.03 ppm. Natural and certain synthetic rubbers are particularly vulnerable. These rubbers when stressed show cracking when exposed to 0.02 ppm laboratory ozone for about 1 hr. Other materials known to deteriorate under atmospheric photochemical smog conditions are textiles and certain dyed fabrics, particularly under conditions of high humidity. Loss of tensile strength of cotton textiles when wet or moist and similar fading of these dyed fabrics, particularly under high humidity, can be also produced by laboratory exposure of these textiles to pure ozone. Ozone effects on asphaltic materials are also reported. (Author's Abs.)

719
Jellinek, H. H. G.
FUNDAMENTAL DEGRADATION PROCESSES RELEVANT TO OUTDOOR EXPOSURE OF POLYMERS. In: Weatherability of Plastic Materials. Ed. by M. R. Kamal. New York, Interscience Publishers, 1967, p. 41-59. (Presented at: Symposium held at National Bureau of Standards, Gaithersburg, Md., Feb. 8-9, 1967).

A survey is presented of the fundamental reactions which can take place when polymers are exposed, separately, to light and oxygen. The kinetics of chain scissioning and crosslinking is presented in some detail. Oxidation is discussed on the basis of Bolland's mechanism. A number of examples in order to illustrate the discussion are given. The simultaneous effect of light and oxygen is illustrated by considering polyethyl acrylate. Lastly, the effect of ozone and air pollutants is briefly discussed. (APTIC Abs.)

720
Jellinek, H. H. G.
THERMAL GRADIENTS IN DEGRADATION REACTIONS. Jour. Polymer Sci., Part A-1, v. 4: 2705-2709, 1966.

The rate-constant differences obtained from degradation of poly(methylmethacrylate) in various reaction vessels were due to thermal gradients caused by endothermic depolymerization. Calculated heat transfer between the outer quartz vessel wall and poly(methylmethacrylate) film compare closely with values from the Arrhenius equations. (Chem. Abs.)

721
Jellinek, H. H. G.
WEATHERABILITY OF PLASTICS. DEGRADATION PROCESSES IN OUTDOOR EXPOSURE. Modern Plastics, v. 44: 162, 1967.

A discussion of the reactions and reaction kinetics of polymers exposed to light, O, ozone, and other chemicals is presented. (Chem. Abs.)

722
Jellinek, H. H. G., and S. Y. Fok.
DEGRADATION OF POLYMERS IN SOLUTION BY FREEZING. Makromolekulare Chemie (Basel), v. 104: 18-25, 1967.

Degradation of poly(vinylpyrrolidone) (I) was carried out by freezing 5 ml aqueous I solution at 45° for 5 min and warming 7 min with hot air. The degradation was similar to ultrasonic degradation by cavitation and may be expressed in a similar manner by an ultrasonic degradation equation derived by Schmid. The chain length decreased with the freezing cycles, becoming constant at a finite chain length and degradation was insensitive to concentration changes. A degradation mechanism was proposed assuming that chain scission is due to impact and (or) frictional forces generated by liquid being pressed out between advancing freezing fronts. (Chem. Abs.)

723
Jellinek, H. H. G., and F. J. Kryman.
GAS ANALYSIS BY POLYMER CHAIN SCISSION: OZONOLYSIS OF POLYSTYRENE. Environ. Sci. & Technol., v. 1: 658-660, Aug. 1967.

Chemical reactions which lead to a few chain scissions in a polymer molecule are easily detectable, therefore the chain rupture should aid in the analysis of minute amounts of gases which react with the polymer molecule leading to scission. The feasibility of gas analysis by random chain scission of linear polymers has been shown in principle. Polystyrene in carbon tetrachloride has been ozonalyzed. Random chain scission with an energy of activation of 28.5 kcal/mole takes place. Under conditions used in present work, 20 ppm can be ascertained quantitatively. The sensitivity of this method can possibly be increased to 0.02 ppm and experiments to this effect are in progress, in addition to experiments of shortening the reaction time and making the apparatus more convenient to handle. (APTIC Abs.)

724
Jellinek, H. H. G., and S. N. Lipovac.
PHOTOLYSIS OF ISOTACTIC POLY(METHACRYLICACID) IN AQUEOUS SOLUTIONS. Jour. Macromolec. Chem., v. 1: 773-797, 1966.

Ultraviolet photolyses with light of wavelength 2537 Å of isotactic poly(methacrylic acid) fractions in aqueous solutions were investigated as a function of pH, polymer concentration, initial d.p., and light intensity. The polymer chains are broken at random with chain-scission quantum yields of the order of 10^{-3}. The chain-scission rate constants and quantum yields decrease in a similar way with increasing pH. Polymer concentraction has no effect on the chain scission rate constants; however, the rate constants increase with increasing initial d.p. The chain-scission rate constants are proportional to the 1st power of the absorbed light intensity, in agreement with a random chain-scission process. The absorbance at 2537Å decreases with increasing pH. The chain-scission rate constants decrease linearly with these absorbances. The decrease of the rate constants with increasing pH is believed to be a direct consequence of the decrease in absorbance, which in turn is due to uncoiling of the chain molecule with increasing degrees of dissociation. This assumption is supported by the fact that the reciprocal chain-scission rate constants are linearly proportional to the fractional root mean end-to-end distance of the chain molecules. Tentative mechanisms of chain scission are briefly discussed. The absorbance of the maximum at ~2070Å increases linearly with time at any one pH value. The corresponding rate constants decrease linearly with increasing pH. The kinetics of the dependence of the absorbances is discussed and possible mechanisms are suggested. The photolyses of the isotactic and atactic poly(methacrylic acid) are compared. The differences in the 2 acids are due largely to their different pK values (pK ≈ 5.7 for atactic acid and 8 for isotactic acid). (Chem. Abs.)

725
Jellinek, H. H. G., and M. D. Luh.
THERMAL DEGRADATION OF ISOTACTIC AND SYNDIOTACTIC POLY(METHYL METHACRYLATE). Jour. Phys. Chem., v. 70: 3672-3680, 1966.

The thermal degradation of isotactic and syndiotactic poly(methyl methacrylate) (I) was studied in a closed system at 300-400° in the absence of air. Kinetic analysis showed that the degradation proceeded by random initiation, depropagation, and disproportionation as the termination reaction. The activation energies for the polymers were 62- 8 kcal/mole, depending on the extent of conversion of polymer to monomer, but the overall activation energy for either polymer was similar. The initial chain lengths of isotactic I were ~10 - 20 times those of syndiotactic I. In the depolymerization the kinetic chain length for isotactic I was smaller than the polymer chains, while that for syndiotactic I was similar to the polymer chain length. The depolymerization of the stereospecific polymers is similar to the 2nd (slow) reaction of atactic I, prepared with Bz_2O_2, which has an activation energy similar to those of stereospecific I. Chain-scission values and monomer formation-rate constants are presented. (Chem. Abs.)

726
Jellinek, H. H. G., and Y. Toyoshima.
REACTION OF NITROGEN DIOXIDE WITH POLYSTYRENE FILMS. Jour. Polymer Sci., Part A-1, v. 5: 3214-3218, 1967.

A study was made of the reaction of NO_2 with polystyrene (I) films. The films were exposed to NO_2 for various times, temperatures, and NO_2 pressures. The exposed films had average molecular weight 1.57×10^{-5} and intrinsic viscosity 0.53 dl/g compared to 3.72×10^{-5} and 1.067, respectively for an unexposed sample. Plots were made of random degradation of I as a function of NO_2 pressure at 55°, random rate constants as a function of NO_2 pressure, and degradation at NO_2 pressure of 30 cm and 35°, in addition to an Arrhenius plot for NO_2 pressure of 30 cm. Ir spectra of the unexposed and exposed sample showed the presence of stretching vibrations due to the NO_2 group on an aliphatic chain in the exposed sample. Possible reactions of NO_2 with I were discussed similarly as the thermal and bulk degradation of I and the reaction of NO_2 with polyethylene. (Chem. Abs.)

727
Lee, R. E., Jr., and E. R. Booser.
LUBRICATION AND LUBRICANTS. Kirk-Othmer Encyclopedia Chem. Technol., v. 12: 557-616, 1967.

A discussion of lubrication principles, petroleum lubricants and additives, synthetic oils, greases, solid-film lubricants, for fastner and bolt assemblies, metalworking lubrication, extreme temperature lubrication (natural oxides and high-temperature lubricants and gas and cryogenic bearing lubrication), and lubricants for missile systems and for nuclear reactors is presented. (Chem. Abs.)

728
Levy, A., and E. L. Merryman.
INTERACTIONS IN SULFUR OXIDE-IRON OXIDE SYSTEMS. Jour. Eng. Power, v. 89: 297-303, 1967.

In order to study corrosion processes and deposits from combustion gases, Fe_2O_3-, Fe_3O_4-, NaOH-Fe_2O_3- and NaOH-Fe_3O_4-coated substrates on Vycor and of Fe were exposed to controlled gas mixtures containing SO_2 and SO_3. Sulfate and sulfide formation were examined and explained on thermodynamic grounds. Examination of the role of MgO coatings indicates a limited protective effect through removal of SO_3 from the gas stream. Sulfate formation by the direct reaction of S oxides and Fe_2O_3 was limited, but increasing the NaOH content of the coating increased sulfate. Adding O to SO_2 increased sulfate formation; the further addition of H_2O had no special effect on Vycor coatings, but decreased sulfate formation on Fe. Flame gases generally increased sulfate on Vycor, but gave no established trend on Fe. Fe_3O_4 reacted directly with sulfur oxides to sulfates. In the absence of NaOH in the coating, SO_3 gases yielded considerably less sulfate than the SO_2-O gases. On vycor, the total sulfate yield appeared independent of the NaOH content and of gas composition (in most cases). Ingeneral, increasing the NaOH content of the coating on Fe resulted in increased sulfate. Adding O to SO_2 resulted in increased sulfate on Fe; further addition of H_2O decreases sulfate. No sulfides were produced on coated Vycor, while maximum sulfides were produced in the absence of O for all NaOH-Fe oxide coatings on Fe. Addition of NaOH to Fe oxide reduced catalysis in SO_2-O mixtures (except for Fe_3O_4 in flame gases). Pure Fe_2O_3 catalyzed the oxidation of SO_2 in all gas mixtures; Fe_3O_4 appeared to catalyze the oxidation of SO_2 (possibly through the decomposition of Fe sulfate). (Chem. Abs.)

729
Reffner, J. A., C. I. Harding and T. R. Kelley.
IDENTIFICATION OF PAINT-DISCOLORED SPECIES BY ELECTRON DIFFRACTION. Jour. Air Poll. Control. Assoc., v. 17: 36-37, Jan. 1967.

Discoloration of exterior paint is shown to occur when H_2S in air reacts with heavy metal salts used as pigments of fungicides in paints. Simple field tests can give an indication whether H_2S was involved. The electron diffraction technique used to identify discolored compounds in paint samples is described, field experience in Jacksonville, Fla, using this method and samples submitted from the area showed that electron diffraction provided the most sensitive analytical technique for identifying products formed by air pollutants on paint surfaces. (Eng. Index)

730
Reid, W. T.
PROTECTING STANDBY EQUIPMENT-CORROSION CONTROL DURING EQUIPMENT SHUTDOWN. Mater. Protection, v. 6: 42-44, 1967.

Corrosion of idle boilers can be prevented by keeping them dry by using desiccants or vapor-phase inhibitors, or by completely filling with water containing an alkali (esp. NH_3 or one of the volatile alkaline N compounds) or an inhibitor such as $Na_2Cr_2O_7$. The water must be deaerated or boiled in the boiler. Special precautions must be taken in the presence of Cu or Cu alloy parts.

Turbines may also need drying to prevent corrosion. Copper-nickel tubes of heaters subject to intermittent operation are subject to exfoliation owing to formation of oxide scale. This can be reduced by steam blanketing when the unit is out of operation, but consideration needs to be given to other alloys for feedwater heaters because of the probability that a plant designed for base load will eventually be used for peaking. (Chem. Abs.)

731
Robinson, E., and F. L. Ludwig.
PARTICLE SIZE DISTRIBUTION OF URBAN LEAD AEROSOLS.
Jour. Air Poll. Control Assoc., v. 17: 664-668, Oct. 1967.

The mass size distribution of urban lead aerosols is similar in widely different environments across the United States. More complete sampling is certainly needed before this finding can be generalized. On the basis of the 59 urban lead aerosol size distribution analyses from widely different parts of the country, the average mass median equivalent diameter is 0.25 μ and the lower and upper quartile points are 0.16 μ and 0.43 μ. All of the aerosol size distributions are integrated samples taken over periods of 4-9 hr, which was the length of time required to obtain a sample sufficient for analysis. The uniformity which was obtained in the sampling results is not attributable to bias introduced by the sampling system. Much of the West Coast sampling data apply to lead aerosols from auto exhausts because of the large amount of traffic in each of the test areas and the general absence of metallurgical industrial emissions. However, Eastern and Midwestern urban locations — which from a general air pollution standpoint were much more heterogeneous — showed similar average size distributions and a similar limited range of extreme values. (Authors' Abs.)

732
Winchester, J. W., and R. A. Duce.
THE GLOBAL DISTRIBUTION OF IODINE, BROMINE, AND CHLORINE IN MARINE AEROSOLS. Naturwissenschaften (Berlin), v. 54: 110-113, 1967.

Atmospheric samples were analyzed for I, Br, and Cl by neutron activation analysis. Aerosols of marine origin, derived from sea spray, are found to contain the halogens in relative proportions different from sea water, and data from Hawaii and winter northern Alaska indicate fractionation of the elements both during transfer across the sea-air interface and by chemical reactions in the atmosphere. The Br/Cl ratio is usually several-fold greater in aerosols over land than in sea water (Br/Cl = 0.0034), but over open sea water it is less. In general, the I/Br ratio has a greater degree of constancy (values cluster in the region I/Br ~0.1-0.2) than does either I/Cl or Br/Cl, suggesting a long residence time and a coherence of I and Br in their motion as particulate material in the atmosphere. However, a singularly effective sea-air transfer mechanism for I is indicated by its generally high atmospheric concentration compared to sea water (I/Br = 0.001). Bromine of pollution origin and associated with Pb was observed in aerosols from Cambridge, Mass. Chlorine and I concentrations are similar to the Hawaii values and provide a basis for resolving excess pollution of Br from the natural marine component. The (excess Br)/Pb ratio in aerosols appears to be correlated directly with the haziness of the air. (Air Poll. Abs.)

733
Yocom, J. E. and R. O. McCaldin.
EFFECTS OF AIR POLLUTION ON MATERIALS AND THE ECONOMY. In: Air Pollution. v. I. Air Pollution and its Effects. Ed. by A. C. Stern. New York, Academic Press, 1968. p. 617-654.

Air pollution has long been a significant source of economic loss in urban areas. Damage to nonliving materials may be exhibited in many ways, such as corrosion of metal. weakening of textiles, soiling and eroding of building surfaces, deterioration of works of art, and fading of dyed materials. Some of the damage mechanisms are examined, attempts to determine the importance of air pollution in relation to other variables in producing damage are made, and the problems involved in translating observable air pollution damage into terms of economic impact are considered. (Author's Abs., Modified.)

IX. AIR QUALITY

734
Adams, D. F., F. A. Young, and R. A. Luhr.
EVALUATION OF ODOR PERCEPTION THRESHOLD TEST FACILITY. Tappi, v. 51: 62A-67A, Mar. 1968.

The test facility consisted of a series of six identical chambers installed in a bus. Trained panelists were consecutively exposed to six chambers, each containing different concentrations of the same compound or purified air. The odor threshold of four sulfur containing compounds was examined. The test atmospheres were presented in ascending, descending, or random order and ranged from undetectable to objectionable. The variability of individual response, including personal, was evaluated over a period of several days. These data form statistical basis for examination of response of nearly 6000 untrained subjects, located at schools, fairs, etc. (Eng. Index)

735
AIR POLLUTION. V. II. ANALYSIS, MONITORING, AND SURVEYING. Ed. by A. C. Stern. New York, Academic Press, 1968, 684 p.

A multiauthor treatise covering the sampling, analysis, measurement and monitoring of air pollution. It is intended as a text or reference on the chemical analysis of air pollutants.

736
Corn, M. and G. Burton.
THE IRRITANT POTENTIAL OF POLLUTANTS IN THE ATMOSPHERE. Arch. Environ. Health, v. 14: 54-61, Jan. 1967.

Daily exposure of the general population to low concentrations of pollutant gases and particles led to the development of experimental methods which assess functional impairment of the organism. The term irritant became associated with substances capable of altering breathing patterns, pulmonary flow resistance or lung compliance, and changing the partitioning of lung volumes. The aerodynamic size of an airborne particle determines its site of deposition and contact with receptors in the respiratory tract after inhalation by man. The data demonstrate the large range of particle sizes present in the atmosphere suggest the need to differentiate in sampling and assessment techniques, the pertinent particular portion of the particles composing the atmospheric aerosol. The most widely accepted indicators of acute irritant action are airway resistance and lung compliance. Airborne particulate pollutants should be assessed with respect to areodynamic particle size because chemical composition of particles vary with size and certain particle sizes, present in polluted atmospheres are capable of reaching receptors after inhalation by man. (APCA Abs.)

737
Dahle, E. W., Jr.
ANNUAL REPORT OF THE BUREAU OF INDUSTRIAL HYGIENE, 1966. Baltimore, Md., Baltimore City Health Dept., Bureau of Industrial Hygiene, 1966, 15p.

Some results of industrial hygiene investigations are cited. The atmospheric monitoring program is discussed and the results of sampling for oxidants, aldehyde, nitrogen dioxide, and dust fall are graphed. Complaints involving air pollution are tabulated.

738
Duprey, R. L.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS. Durham, N. C., Public Health Service, National Center for Air Pollution Control, 1968, 67p. (PHS Publ. No. 999-AP-42).

Because of the diversity and complexity of the sources of air pollution, the atmospheres of our metropolitan areas contain numerous chemical substances and their derivatives or oxidation products. To assess the relative contribution of the sources of air pollution, the major types and quantities of pollutants emitted must be determined. The contributions of the following to air pollution are discussed: fuel combustion, refuse incineration, chemical process industry, food and agricultural industry, metallurgical industry, mineral products industry, petroleum refinery, pulp and paper industry, solvent evaporation and gasoline marketing and transportation. The brief discussions of these air pollution sources include emission factions.

739
Ehhalt, D. H.
METHANE IN THE ATMOSPHERE. Jour. Air Poll. Control Assoc., v. 17: 518-519, 1967.

Methane is present in the troposphere with a volume concentration of about 1.5 ppm. Estimates of Koyama (1963) indicate a predominantly biological origin with a total production rate of about 2.7×10^{14} g CH_4/yr so that the atmospheric lifetime of methane is around 20 yr. Measurements of the C-14 in methane by Libby and later by Bainbridge, et al, (1961) gave a C-14 content of 75% of recent wood and, therefore, confirm the predominant biological origin, the addition of inactive CH; from industrial sources being only about 25%. Much less is known about sinks of CH_4. Cadle (1966) reported fairly high destruction rates by atomic O, a reaction which should be important at high altitude. Bainbridge (1966) reports a decrease in the measured methane concentration above the tropopause but considers this decrease too small to account for the destruction rate of 20 yr estimated by Koyama. Measurements on air samples collected on aircraft flights at various altitudes show a high variability of the CH_4 content both with time and altitude. (Author's Abs.)

740
Horvath, H.
A COMPARISON OF NATURAL AND URBAN AEROSOL DISTRIBUTION MEASURED WITH THE AEROSOL SPECTROMETER. Environ. Sci. & Technol., v. 1: 651-655, Aug. 1967.

The atmospheric aerosol consists of particles from various sources. The concentration variation can be easily obtained from studies of the visual range but for more detailed information, knowledge of the size frequency of the aerosol is desirable. The Goetz aerosol spectrophotometer measures size frequencies in the range of 0.2 to 0.05 microns in diameter. The size range to be precipitated can be varied, different particle sizes can be roughly determined. Air samples were collected with the aerosol spectrophotometer in town and in the mountains. By counting the deposited particles in the microscope, the size frequency of the aerosol was determined. The lower measuring range was limited by the microscope to 0.27 microns. In this range, the size frequency curve of the atmospheric aerosol has in general the same shape for natural and urban aerosols. The highest concentrations, about 5,000 particles per cc were measured at intersections with heavy traffic. In less busy areas of town, the particle number was 800 particles per cc or less and in the mountains, 300 particles per cc or less. Normally, the particle number decreases during rainfall and increases in fair weather, whereas the mode of particle size increases slightly during rainfall and decreases during fair weather. The smallest particles occur in combustion aerosols. Investigations on the metastability of the particles showed that the urban aerosol is less stable than the natural aerosol. (APTIC Abs.)

741
Kupchik, G. S., M. D. Thomas, and E. R. Hendrickson.
DEVELOPMENT OF A MANUAL OF METHODS FOR AMBIENT AIR SAMPLING ANALYSIS. Presented at: Internat. Clean Air Congress, London (England) Oct. 1966. (Abstract in: Smokeless Air, v. 37: 128, 1966).

Attention is drawn to the need to standardize methods of measuring and evaluating air pollution. With this end in view, seven professional bodies and the U. S. Public Health Service are co-operating in a critical study of the methods now in use. Fifteen hundred methods have been indexed and thirty methods written up; eventually one of them may receive approval as a "standard" method.

742
Lininger, R. L., R. A. Duce, J. W. Winchester, and others.
CHLORINE, BROMINE, IODINE, AND LEAD IN AEROSOLS FROM CAMBRIDGE, MASSACHUSETTS. Jour. Geophys. Research, v. 71: 2457-2463, May 1966.

The ranges 1 to 6 $\mu g\ Cl/m^3$ STP and 2 to 10 $ng\ I/m^3$ STP are in good agreement with observations in unpolluted Hawaii air, but the range 20 to 800 $ng\ Br/m^3$ STP stands an order of magnitude higher and agrees with observations in Washington, D. C., polluted air. Lead concentrations are 0.1 to 2.2 $\mu g\ Pb/m^3$ STP and are strongly correlated with high Br concentrations during hazy weather (low visibility) and/or curb-site sampling. The data suggest that the initial exhaust product is a particulate lead halide that suffers loss of Br in the atmosphere. (Authors' Abs.)

743
McCarroll, J., E. J. Cassell, D. W. Wolter, and others.
HEALTH AND THE URBAN ENVIRONMENT: V. AIR POLLUTION AND ILLNESS IN A NORMAL URBAN POPULATION. Arch. Environ. Health, v. 14: 178-184, 1967.

In applying the techniques of time-series analysis to large volumes of health and air pollution data over long periods, it is possible to demonstrate a consistent relationship between certain measures of environmental pollution and the presence of symptoms in a "normal" urban population. (Authors' Abs.)

744
Maga, J. A., and M. Ascе.
VEHICULAR POLLUTION EFFECTS IN URBAN DEVELOPMENT. Jour. Urban Planning Develop. Div., Proc. Amer. Soc. Civil Engrs., v. 93: 231-241, Dec. 1967. (Presented at: Amer. Soc. of Civil Engrs. Transport. Eng. Conf., Philadelphia, Pa., Oct. 17-21, 1966).

Toxic emissions from motor vehicles such as CO, hydrocarbon and nitrogen oxides in urban areas were measured. The tabulated results indicate that operation of large numbers of motor vehicles cause high concentrations of these contaminants in the urban atmosphere. The direct relationship between emissions and atmospheric concentrations is found in localized situations as well as community-wide air pollution. The quantity of exhaust contamination emitted can be related to traffic patterns and vehicle operating modes. Stop and go driving results in more pollutants than unimpeded flow. The present approach to the reduction of motor vehicle emissions, which is based mainly on engine modification and the use of control devices, is not sufficient. Additional benefits can be obtained through highway design, mass transit and urban planning. (APTIC Abs.)

745
Mueller, P. K.
AEROSOL INVESTIGATIONS - CALIFORNIA STATE DEPT. OF PUBLIC HEALTH. Jour. Air Poll. Control Assoc., v. 17: 583-584, Sept. 1967.

These investigations are designed to provide information about the concentration, size distribution, and chemical composition of particulates in sources of air pollution and in the atmosphere. The purpose of these investigations are to enable the assessment of health hazards from urban aerosols, to establish air quality criteria and standards and to evaluate the effectiveness of control efforts. Four current projects are clearly identifiable: (1) Size-selective sampling for particulate matter in an urban atmosphere, (2) Collection and analysis of aerosols for inorganic constituents, (3) Feasibility of dust counting with the Coulter counter, and (4) Fine particles and lead concentrations in car exhausts. (Air Poll. Abs.)

746
Sarkanen, K. V.
EFFECT OF NEW PROCESS TECHNOLOGY ON AIR POLLUTION POTENTIAL. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, Apr. 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n. d., p. 311-334.

Even under the most ideal conditions the kraft process will still release some odor. A complete solution of the odor problem would involve the development of a sulfide-free pulping system capable of producing pulp with equal or better qualities than the kraft process. Two approaches are considered for the development of a sulfide-free alkaline pulping system: (1) to find a chemical agent to substitute for the sulfide ions or (2) to stabilize the polysaccharide components to the degree of sufficient survival under the longer reaction periods necessary for delignification by NaOH alone. Sulfide-free alkaline pulping systems are discussed and the conclusion reached that they well may provide the ultimate solution for kraft mill odor problems.

747
Sawicki, E.
AIRBORNE CARCINOGENS AND ALLIED COMPOUNDS. Arch. Environ. Health, v. 14: 46-53, 1967.

The billionfold range in concentrations of some of the known components of the urban atmosphere is given. The variation is from

6×10^8 µg/1,000m^3 for CO_2 to 0.2 µg/1,000m^3 for dibenz(a, h) acridine. A wider variety of large organic compounds are found in the urban atmosphere. Some of the families of compounds which were identified include n-alkanes, proteins, aromatic hydrocarbons, aza heterocyclic compounds, imino heterocyclic compounds, polynuclear carbonyl compounds, quinones, acids, and phenols. Four types of carcinogens were found in the urban atmosphere. These include polynuclear aromatic hydrocarbons, polynuclear aza heterocyclic compounds, polynuclear amino heterocyclic compounds (in air pollated by coal-tar-pitch fumes), and polynuclear ring carbonyl compounds. The presence of alkylating agents in aliphatic and other and other fractions of airborne particulates indicates the probable presence of mutagens and other, as yet unisolated, types of carcinogens. The number and type of carcinogens found in the atmosphere indicate that attempts to correlate carcinogenicity of the mixtures in our chemical environment with the concentrations of 3, 4-benzypyrene are probably naive. Nothing can be said about the anticarcinogens and cocarcinogens until the composition of environmental mixtures in terms of these compounds is known. (Author's Abs.)

748
Sawicki, E., T. W. Stanley, and W. C. Elbert.
ANALYSIS OF THE URBAN ATMOSPHERE AND AIR POLLUTION SOURCE EFFLUENTS FOR PHENALEN-1-ONE AND 7 H-BENZ(DE) ANTHRACEN-7-ONE. Mikrochimica Acta (Wien), v. 5-6: 1100-1123, 1965.

Through the use of 1- and 2-dimensional thin-layer chromatography and direct spectrophotofluorometric examination of thin-layer plates, 2 members of a new family of compounds were found in the atmosphere. Phenalen 1-one and 7 H-benz(de)anthracen-7-one were identified and determined in particulates obtained from urban atmospheres and air pollution source effluents. Scanning techniques and other methods of analysis were also used in characterization and estimation. Two-dimensional thin-layer chromatography followed by direct spectrophotofluorometric analysis appears to be the most promising chromatographic method for the routing analysis of chemical compounds in complex mixtures. It approaches colorimetric analysis in simplicity and speed and surpasses it in sensitivity, selectivity and the amount of information that can be obtained from one analysis. (Authors' Abs.)

749
Tabor, E. C.
CONTAMINATION OF URBAN AIR THROUGH THE USE OF INSECTICIDES. Trans. New York Acad. Sci., v. 28: 569-578, 1966.

Results of this investigation show that the air over many communities is contaminated with substantial amounts of a variety of insecticides. The concentrations observed represent minimum values, since the sampling method did not collect pesticide vapors and some of the collected aerosols could have been lost by vaporization during the sampling period. These minimum values demonstrated that the ambient air can be a medium for nonoccupational exposure to insecticides. (Biol. Abs.)

750
Turk, A.
SELECTION AND TRAINING OF JUDGES FOR SENSORY EVALUATION OF THE INTENSITY AND CHARACTER OF DIESEL EXHAUST ODORS. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 45p. (PHS Publ. No. 999-AP-32).

The sensory evaluation of diesel exhaust odor will provide part of the basis for specifying permissible conditions of exposure. Human judges, specially selected, will be trained to improve their odor discrimination, become familiar with diesel exhaust odor, and rate the odor in terms of reference intensity and quality standards. (Public Health Eng. Abs.)

(a) Area Surveys

751
Adams, D. F., and R. K. Koppe.
AN AIR QUALITY STUDY IN THE VICINITY OF LEWISTON, IDAHO, AND CLARKSTON, WASHINGTON. Jour. Air Poll. Control Assoc., v. 16: 314-316, 1966.

This report summarizes data and conclusions from a 1-year, interstate air quality study conducted in 1962 in the vicinity of Lewiston, Idaho, and Clarkston, Washington. The sampling and analyses techniques were selected to permit differentiation between possible sources and types of air pollutants. (Authors' Abs.)

752
Altshuller, A. P., G. C. Ortman, B. E. Saltzman and others.
CONTINUOUS MONITORING OF METHANE AND OTHER HYDROCARBONS IN URBAN ATMOSPHERES. Jour. Air Poll. Control Assoc., v. 16: 87-91, 1966.

Continuous measurements of total hydrocarbons (and other organic substances) and of methane were made in Cincinnati and Los Angeles for 3-mo periods. Some of the measurements were made during episodes of photochemical air pollution. Two instruments, one for measurement of total hydrocarbons and the other for methane, were operated in parallel. Both incorporated flame ionization detectors having greater sensitivity than commercial flame ionization instruments. The flame ionization analysis for methane was made specific by use of an adsorbent carbon column preceding the analyzer to retain all organic substances except methane. Substracting the methane concentration values from those for total hydrocarbons gave no methane hydrocarbon concentrations. The data showed diurnal patterns of concentrations of methane and nonmethane hydrocarbons in the atmosphere. Average hourly values for methane were strikingly similar in Los Angeles and in Cincinnati (2.6 and 2.4 ppm, respectively); those for nonmethane hydrocarbons were 4 times as high in Los Angeles (3.0 and 0.8 ppm, respectively). A bimodal frequency distribution pattern of the concentrations suggested that atmospheric ventilation was either good or poor, with less than a random amount of time in intermediate stages. The width of that for nonmethane hydrocarbons, indicating a different and more constant source for the former. (Authors' Abs.)

753
Blemel, K. G.
ATMOSPHERIC LEAD CONCENTRATIONS AS A FUNCTION OF METEOROLOGY. Arch. Environ. Health, v. 14: 594-603, 1967.

Curvillinear numerical programming techniques established basic relationships between concentrations of atmospheric lead particulate and the concurrent meteorology. Once the mathematical model was maximized to desired or possible levels, predictions were made of the extreme concentrations possible under existing conditions. The model derived for samples at the philadelphia International Airport was a combination of an inverse logarithm of the wind speed and directional coefficient of the wind vector. The effect of inversions or atmospheric stability on concentrations generated over a flat topographical area was minimal when averaged over 48 hrs. Under special conditions, concentrations of lead particulate in the atmosphere can be expressed as a function of wind, emissions, and traffic patterns. Ideal conditions of flat terrain and long sample duration can be investigated by curvilinear parametric numerical techniques with the use of a mathematical model developed through statistical techniques of correlation. Such investigations can estimate the contribution of automotive exhaust to atmospheric pollution and estimate the meteorological dispersion of vehicular lead emissions in a central city location with comprehensive traffic and meteorological data. Perhaps, through such investigations the contribution of automotive exhaust to atmospheric pollution can be estimated with the use of lead concentrations as the indicator. (Author's Abs.)

754
Clarke, J. F., and R. B. Faoro.
AN EVALUATION OF CO_2 MEASUREMENTS AS AN INDICATOR OF AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 16: 212-217, Apr. 1966.

Measurements of ambient carbon dioxide (CO_2), made at the Continuous Air Monitoring Program station in downtown Cincinnati, Ohio, and at a rural location near Cincinnati are presented and evaluated to determine the significance of CO_2 data in urban air quality monitoring programs. Through analysis of rural CO_2 data and evaluation of combustion sources by means of a diffusion model, it is demonstrated that the variation of urban CO_2 concentrations around the prevailing atmosphere background level results from combustion and noncombustion (natural) sources. The concentration from natural sources. can be substantial and in fact override the combustion sources. Because it is not yet practical to predict the contribution of natural sources to urban CO_2 concentrations, data obtained for this gas have only limited utility as an index of air quality. Significant statistical relationships between CO_2 data and air quality measurements for summer months are shown to result from similar meteorological effects rather than similar sources. A seasonal and spatial variation of these relationships is postulated and subsequently demonstrated by analysis of CO_2 and air quality measurements from New Orleans, Louisiana, and St. Louis, Missouri. (Authors' Abs.)

755
Davidson, B.
A SUMMARY OF THE NEW YORK URBAN AIR POLLUTION DYNAMICS RESEARCH PROGRAM. Jour. Air Poll. Control Assoc., v. 17: 154-158, Mar. 1967.

A description is given of the experimental techniques employed in a study of urban air pollution in the New York metropolitan area. The experimental measurements consist of an anemometer network, an SO_2 ground network, an upper level wind network and programmed flight of a helicopter, and fixed winged aircraft equipped to measure pressure height, temperature, wet bulb depression, and SO_2 concentration. Some highlights of the observational program are shown. These include detailed pictures of the height distribution of the urban heat island, associated wind flow patterns, and their effect on the distribution of concentration within the city. Some examples are given of the three-dimensional distribution of temperature and SO_2 within the urban area. These observations are discussed in the context of a numerical model. (Author's Abs.)

756
Hamming, W. J., G. MacBeth, and R. L. Chass.
THE PHOTOCHEMICAL AIR POLLUTION SYNDROME: EXHIBITED BY ATTACK OF OCTOBER 1965. Arch. Environ. Health, v. 14: 137-149, 1967.

The photochemical "air pollution syndrome" which occurred on Oct. 26 - 28, 1965 in Los Angeles, California, was typical and followed the pattern set by previous smog attacks. This pattern is due to low wind speeds which concentrate the pollution in one area, low inversion heights that prevent vertical mixing to dilute the emitted materials, a trajectory which carries the emitted pollution to surrounding communities in the afternoon, and sufficient sunlight to photodissociate the NO_2 formed and to form NO and O_2. The results are high levels of oxidant or ozone and large quantities of submicron size particles. Eye irritants and plant damaging chemicals are also formed. Extensive work is being done by the University of Southern California with assistance from the US Public Health Service on the cancer-forming potential of air irritants, but no health studies are being done specifically on aerosols formed from photochemical reactions involving NO and hydrocarbons. (Biol. Abs.)

757
Jenkins, H. N., and T. O. Harris.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: IV ODOURS - RESULTS OF SURVEYS. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, June 1966, 48p.

A survey undertaken to investigate the odour problems in the St Louis Metropolitan area is described. Observations were made at 79 different places most of which were at fire stations. These were chosen because they are distributed relatively uniformly throughout the area. The odours were classified into ten different types and the type of odour, frequency of detection, data and time of day were reported. Meteorological conditions were also taken into account. (Air Poll. Abs.)

758
Johnson, R. E., A. T. Rossano, and R. O. Sylvester.
DUSTFALL AS A SOURCE OF WATER QUALITY IMPAIRMENT. Proc. Amer. Soc. Civil Eng., Jour. Sanitary Eng. Div., v. 92: 245-257, Feb. 1966.

An investigation was made of dustfall during the months of June, July, and August, 1964, in Seattle, Washington, and surrounding areas to determine the possible effects of dustfall on reservoir water quality. Several components of dustfall were measured at 46 stations located within Seattle and its suburbs. The methods of sampling and analysis are described. The dustfall rates and their significance in terms of water quality, source, and meteorological factors are examined. (Air Poll. Abs.)

759
Konopinski, V. J. and J. B. Upham.
COMMUTER EXPOSURE TO ATMOSPHERIC LEAD. Arch. Environ. Health, v. 14: 589-594, Apr. 1967.

A method of sampling for atmospheric particulate lead from a moving vehicle is described. Commuter exposure to lead levels measured in Cincinnati, Los Angeles, and San Francisco are presented. Mobile sampling was conducted on representative traffic aeteries in each city during the morning and afternoon traffic rush and during midday. Background levels were also measured on rural routes. Mean concentrations ranged from 9 $\mu g/m^3$ to 38 $\mu g/m^3$ in weekday samples from downtown and freeway routes, and from 2.8 $\mu g/m^3$ to 5.8 $\mu g/m^3$ for rural roads. In Los Angeles on the Hollywood and Harbor Freeways and at the "stack," 11 to 14 samples had concentrations greater than 40 $\mu g/m^3$ and the maximum single measurement was 71.3 $\mu g/m^3$. (Authors' Abs.)

760
Korshover, J.
CLIMATOLOGY OF STAGNATING ANTICYCLONES EAST OF THE ROCKY MOUNTAINS, 1963 - 1965. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 15p. (PHS Publ. No. 999-AP-34).

Since stagnating anticyclones are often associated with incidents of heavy air pollution in urban areas, a 30-year climatology is presented to delineate occurrences of stagnating anticyclones in the eastern United States. Occurrences of stagnation are determined on the basis of pressure-gradient values considered with other meteorological factors. Affected areas are depicted on maps by use of a system of grid points. Data showing cases of stagnation (i. e., episodes) and total days of stagnation indicate that stagnation is most likely to occur in autumn months. (Author's Abs.)

761
LEWISTON, IDAHO- CLARKSTON, WASHINGTON AIR POLLUTION ABATEMENT ACTIVITY. Washington, D. C., Public Health Service, National Center for Air Pollution Control, Feb. 1967. 61p.

Investigations of air pollution in the community have been concerned with air quality, meteorology, sources of pollutants, and various effects of air pollution. There are numerous sources of air pollution in the community; the largest of these is a kraft pulp mill located just east of Lewiston. Other sources include: Lumbering Operations; Asphalt Mix Plants; Food Processing Plants; Concrete Mixing and Grain Handling; Fuel Usage; Refuse Disposal; and Vehicular Emissions. The interstate movement of pollutants, particularly odorous gases emitted by the pulp mill in Idaho and transported to Clarkston, Wash., has been demonstrated. In a public opinion survey in Clarkston, Washington, more than 90 percent of the persons interviewed perceived air pollution in the community as a malodor problem The pulp mill reported emissions amounting to about 1800 lb of hydrogen sulfide, 2500 lb of mercaptans, and 1000 lb of organic sulfide gases per day; about 23, 000 lb of particulates, consisting mostly of sodium sulfate and sodium carbonate, per day, from the mill's recovery furnaces; and an average of about 9700 tons of water vapor per day from all operations. Calculated daily emissions of selected pollutants from sources other than the pulp mill included about 4000 lb of particulates, 100, 000 lb of carbon monoxide, and more than 20, 000 lb of hydrocarbons. About two-thirds of the community emissions are released in Idaho and about one-third in Washington. The valley topography of the Lewiston-Clarkston area results in the transport of air pollutants alternately from either of the states to the other. (APTIC Abs.)

762
Lodge, J. P., Jr., and J. B. Pate.
ATMOSPHERIC GASES AND PARTICULATES IN PANAMA. Science, v. 153: 408-410, 1966.

The concentrations of trace gases in tropical air from samples taken on the Isthmus of Panama are compared with those reported by others. The role of a tropical land mass as a sink or source of atmospheric components is discussed. (Authors' Abs.)

763
McCarroll, J. R., E. J. Cassel, W. T. Ingram and others.
HEALTH AND THE URBAN ENVIRONMENT: HEALTH PROFILES VERSUS ENVIRONMENTAL POLLUTANTS. Amer. Jour. Public Health, v. 56: 266-275, 1966.

The organization and early findings of a study of the effects of air pollution on a group of New York City residents are reported. Preliminary analysis indicates reaction patterns and possible etiologic factors. Methods of more discriminating analysis may permit identification of unsuspected effects upon health. (Air Poll. Abs.)

764
MacPhee, R. D., and A. H. Bockian.
SUSPENDED PARTICULATES IN THE LOS ANGELES ATMOSPHERE. Jour. Air Poll. Control Assoc., v. 17: 580, Sept. 1967.

Several limited surveys of suspended particulate and metals concentrations in the atmosphere have been carried out by the Air Pollution Control District since 1949. The National Air Sampling Network of the U. S. Public Health Service started regular biweekly sampling of the downtown Los Angeles atmosphere in 1954. Several other stations in the L. A. basin were also used by NASN- but the latter were sampled only on alternate years. More recently, the APCD has operated an increased particulate sampling program to obtain more frequent samples at a number of air monitoring stations. The data collected are expected to define trends in the atmospheric levels, delineate certain sources of pollution, and show the effects of air pollution controls. This report presents a brief discussion of the levels of total particulates, sulfates, and nitrates determined for 1966. (Air Poll. Abs.)

765
Maga, J. A., H. Wong-Woo, and M. G. Mason.
MOTOR VEHICLE POLLUTION IN CALIFORNIA. Jour. Air Poll. Control Assoc., v. 17: 435-438, 1967.

Legislation first enacted in 1959 and modified during the past seven years created the program to control motor vehicle air pollution in California. Under this program emission control systems have been installed on many vehicles and for the first time large quantities of contaminants from motor vehicles have been prevented from entering the atmosphere. Nevertheless, motor vehicle emissions continue to be the major source of air pollution. This report will review the accomplishments to date, indicate problems that exist, and evaluate the outlook for control by analyzing emissions trends in four urban areas in the state. (Authors' Abs.)

766
NEW YORK- NEW JERSEY AIR POLLUTION ABATEMENT ACTIVITY. PARTICULATE MATTER. II. PRE-CONFERENCE INVESTIGATIONS. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, Dec. 1967, 206p.

An investigation of particulate matter air pollution conducted in the New York- New Jersey metropolitan area in 1966 and 1967 is reported. The report include these topics: History of Abatement Action; Description of Study Area; Climatology; Project Design; Air Quality Data; Particulate Emission Inventory; Meteorological Representativeness; Impact of Particulate Pollution on Study Area; Summary of Particulate Air Pollution Standards, Criteria, and Objectives; Comparison of Current Levels with Standards or Objectives; Anticipated Reductions in Particulate Emissions; Conclusions and Recommendations of Interstate Air Pollution New York New Jersey Metropolitan Area, January 1967; Aerometry Operations and Techniques; Emissions Inventory Procedure; and Pollutant Measurement Data. (APTIC Abs.)

767
PARKERSBURG, WEST VIRGINIA-MARIETTA, OHIO AIR POLLUTION ABATEMENT ACTIVITY. Washington, D. C., Public Health Service, National Center for Air Pollution Control, Mar. 1967, 87p.

An investigation of air pollution in the interstate area encompassing Marietta, Ohio; Parkersburg, West Virginia; and Vienna, West Virginia was conducted. The average concentrations of suspended particulates measured in the three major population centers was in excess of 150 μg per cubic meter with maximum daily values in excess of 500 μg per cubic meter. The average value for 2-hr sulfur dioxide measurements made at three locations was approximately 0.02 part per million parts of air. At the Vienna station, however, a daily average concentration of 0.10 part of sulfur dioxide per million parts of air was exceeded 3.4 percent of the time. Short-term concentrations approached one part sulfur dioxide per million parts of air at various times. Sensitive vegetation exposed in

Vienna developed injury that was attributed to the synergistic action of ozone and sulfur dioxide in low-level combination. Damage to indigenous vegetation from sulfur dioxide and fluorides was also observed. Atmospheric corrosion of ferrous metals was not abnornally high. Tarnishing of silver plate indicated, however, that the presence of gaseous sulfides is consistent with reported complaints of odor nuisance. From an inventory of emissions of sulfur oxides and particulate pollutants it is estimated that more than 123, 000, 000 lb of sulfur oxides and 25, 000, 000 lb of particulate pollutants are emitted each year from sources in the survey area. Approximately 85 percent of the sulfur oxide and 55 percent of the particulate matter are emitted from sources in Ohio, and 15 percent of the sulfur oxides and 45 percent of the particulate matter from sources in West Virginia. Eight point sources account for almost 98 percent of the total sulfur oxides and 94 percent of total particulate emissions. Mathematical applications of diffusion theory were used to estimate the relative contributions of specific sources. (APTIC Abs.)

768
PILOT STUDY OF ULTRAVIOLET RADIATION IN LOS ANGELES, OCTOBER 1965. (A REPORT ON CONCURRENT MEASUREMENTS MADE BY COOPERATING ORGANIZATIONS BY VARIOUS METHODS). Ed. by J. S. Nader. Cincinnati, Ohio. Public Health Service, National Center for Air Pollution Control, 1967, 91p. (PHS Publ. No. 999-AP-38) (Presented at: 4th Internat. Biometeorol. Congr. Rutgers Univ., New Brunswick, N. J., Aug. 26-Sept. 2, 1966).

Measurements of 300-380-nm UV radiation in Los Angeles were conducted under varying conditions of smog environment, below and above the urban smog layer, and at various elevations through the smog atmosphere in October 1965. The UV energy incident on a horizontal plane surface detector near ground level at solar noon on a clear day (no smog) was 31 w/m square meter or 37% of the maximum possible for that date based on the value of 85 w/m^2 of UV radiation entering the earth's atmosphere. Attenuation of UV radiation varied with smog intensity. Transmission through the atmosphere from 5700 ft (Mt. Wilson) to 350 ft (Laboratory rooftop) above sea level, average through the day, was 87% for a clear day and 65% for a moderate-to-heavy smog day. Outgoing radiation was significantly increased by the smog environment. In heavy smog, values were higher by a factor of about 2 than those obtained in a nosmog environment. Outgoing radiation also tended to increase exponentially with elevation.

UV scatter or transmission measurements appear to offer potential as a sensitive method of monitoring environmental smog levels as an alternative to visibility which is subjective and semiquantitative. The high scattering capability of a smog atmosphere points to the need of measurements of UV radiation in all directions, particularly as this applies to photochemical reactions in the atmosphere, and a correlation of such measurements with measurements of vertical components. (Author's Abs.)

769
Ramsey, J. M.
CONCENTRATIONS OF CARBON MONOXIDE AT TRAFFIC INTERSECTION IN DAYTON, OHIO. Arch. Environ. Health, v. 13: 44-46, 1966.

The concentration of carbon monoxide in the immediate vicinity of major traffic intersections of Dayton, Ohio were determined and the data categorized with respect to variables such as time, traffic volume, meteorological variations, and a comparison of intersection concentrations with those elsewhere in the city. The methods and procedures used are described.

770
REPORT FOR CONSULTATION ON THE METROPOLITAN CHICAGO INTERSTATE AIR QUALITY CONTROL REGION (INDIANA-ILLINOIS). Washington, D. C., Health Service. National Air Pollution Control Administration, Sept. 1968, 85p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, of the metropolitan Chicago urban area are presented. Boundaries for the Metropolitan Chicago Interstate Air Quality Control Region are proposed on the basis of all available and pertinent data. The boundaries remain subject to revision suggested by consultation with State and local authorities. An evaluation of the urban and engineering factors involved is included.

771
REPORT FOR CONSULTATION ON THE METROPOLITAN PHILADELPHIA INTERSTATE AIR QUALITY CONTROL REGION (PENNSYLVANIA - NEW JERSEY - DELAWARE). Washington, D. C., Public Health Service, National Air Pollution Control Administration, Oct. 1968, 76p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, of the metropolitan Philadelphia urban area are presented. Boundaries for the Metropolitan

Philadelphia Interstate Air Quality Control Region are proposed on the basis of all available and pertinent data. The boundaries remain subject to revision suggested by consultation with State and local authorities. An evaluation of the urban and engineering factors involved is included.

772
Robison, C. B., F. L. Meadows, and J. J. Henderson.
ALABAMA RESPIRATORY DISEASE AND AIR POLLUTION STUDY. II. AIR POLLUTION PATTERNS IN THE GREATER BIRMINGHAM AREA. Arch. Environ. Health, v. 15: 703-727, Dec. 1967.

In 1962, the Alabama Respiratory Disease and Air Pollution Study was initiated to determine the prevalence of various pulmonary disorders and to relate these findings to air quality data. This paper describes part of the aerometric effort begun in December 1963 in the Greater Birmingham Area. Samples for analysis of suspended particulate, dustfall, sulfation, and 24-hour gases (nitrogen dioxide, sulfur dioxide, and aldehydes) were collected routinely from 21 stations located primarily in residential areas. Aliphatic aldehydes were found to be normally distributed. Suspended particulate and dustfall levels were extremely high in certain locations throughout the the area. The annual mean for suspended particulates from this network was 125 $\mu g/m^3$, which is considerably higher than the national urban mean. Seasonal means at several stations often exceeded 200 mi $\mu g/m^3$. The annual mean for dustfall was 22 $tons/mi^2/mo$, which is higher than the annual mean reported in either Nashville or St. Louis. For the entire network, sulfation and SO_2 pollutants were found in relatively low concentrations. The annual mean for sulfation was 0.16 $SO_3/100\ cm^2/day$, and for sulfur dioxide, 0.2 ppm. The nitrogen dioxide annual mean for the 21 stations was 7.1 ppm, which is higher than levels found in most NASN cities. The annual mean for aliphatic aldehyde was 1.4 ppm. (Authors' Abs., Modified)

773
Sakabe, H. H. Matsushita, H. Hayashi, and others.
MINERAL COMPONENTS AND 3, 4-BENZPYRENE IN AIR POLLUTANTS OF TOKYO. Indus. Health, v. 3: 126-139, 1965.

Minerals and 3,4-benzpyrene in particulate pollutants in winter air of Tokyo were studied. The minerals found in Tokyo air pollutants were quartz, feldspar, cristobalite, mica and kaolin minerals. The highest concentration of quartz in the air during this survey was 0.034 mg/m^3, and mean concentration of 3,4-benzpyrene in Tokyo air was 15.1 μg/1000 m^3. Results are discussed in relation to "Tokyo-Yokohama asthma" and lung fibrosis. (Biol. Abs.)

774

Schueneman, J. J., J. D. Williams and N. G. Edmisten.
AN AIR RESOURCE MANAGEMENT PROGRAM FOR THE NASHVILLE METROPOLITAN AREA. Atmos. Environ., v. 2: 353-382, July 1968.

A comprehensive study of air pollution levels; the effects on health, visibility and public opinion; sources of pollutants; and the relationships among air pollution, meteorology and topography was conducted in Nashville-Davidson County, Tennessee. Principal sources of sulfur dioxide are use of coal and industrial processes. Major sources of particulate matter are industrial processes and use of coal. Other emissions are tabulated. Pollution by sulfur dioxide and particulate matter is excessive during the winter space heating season. Extensive data are summarized on these pollutants, dustfall and carcinogens. Relationships between pollution levels and anthracosis, bronchial asthma, morbidity, respiratory disease mortality and cardiovascular disease mortality are summarized. Visibility obstruction is tabulated and the opinions of people indicating their awareness and concern about air pollution are described. A detailed discussion of an air resource management program include proposed air quality goals, emission regulations, and program activities. Brief mention is made of application of a mathematical atmospheric dispersion model to air and land-use planning. (Authors' Abs.)

775

Smith, D. B.
TRACER STUDY IN AN URBAN VALLEY. Jour. Air Poll. Control Assoc., v. 18: 600-604, Sept. 1968.

Results of a series of nighttime tracer experiment conducted during the Autumn of 1966 in the industrialized valley of Johnstown, Pa., are discussed. Quite atypical meteorology and dispersion occur within a classical drainage flow framework. An urban heat island effect is observed creating uniform temperature and wind structures within a layer of air flowing through the valley. Dispersion in the valley at night is comparable to that of neutral conditions over open country. (Author's Abs.)

776
Upham, J. B.
ATMOSPHERIC CORROSION STUDIES IN TWO METROPOLITAN AREAS. Jour. Air Poll. Control Assoc., v. 17: 398-402, June 1967.

Atmospheric corrosion studies using established air monitoring network sites were conducted in metropolitan St. Louis and Chicago to obtain information on the quantitative relation between mean pollution levels and corrosion losses. The studies are described and data are presented showing the good correlation found between corrosion losses and sulfur-related pollutants and the insignificant effect of dustfall and suspended particulate matter. (Author's Abs.)

777
Winchester, J. W., W. H. Zoller, R. A. Duce, and others.
LEAD AND HALOGEN IN POLLUTION AEROSOLS AND SNOW FROM FAIRBANKS, ALASKA. Atmos. Environ., v. 1: 105-119, 1967.

The composition of lead halide pollution aerosol particles was studied in the Fairbanks area during Jan. and Feb. 1965. At this time of year the sun is above the horizon for less that 4 hr prolonged cold spells (surface air temperature below -40°C) are accompanied by strong (gradients of 20-30°C/100 m) surface inversions which severely restrict the dilution volume for air pollutants. Indeed, these inversions virtually decouple the dense surface air-layer from the overlying air. Accurate quantitative information on the total output of all pollution sources is available because of the isolated location of Fairbanks and the limited, measurable sources of fuel supply. Thus, Fairbanks is a model locality for studying the production, movement, and chemical reactions of air pollutants in what amounts to a simple two-layer atmosphere. Lead was determined by inverse polarography in aerosol particles collected on Millipore filters. Measured values ranged from 6.0 μg of lead/m^3 of air in the city center, near the automobile traffic center, to 0.19 at the University of Alaska campus outside the city. These do not represent maximum values, because pollutant-concentrating conditions were relatively mild during the sampling periods. Halogens were determined by neutron activation analysis of material in the aerosols and in ground-lying snows, and two components were revealed: a pollution component derived from automotive ethyl fluid combustion, and a low-level natural component. In the pollution aerosol component, the weight ratio Cl/Pb averages close to the ethyl fluid value of 0.34, but Br/Pb is up to four times less than the ethyl fluid value of 0.39. Bromide-chlorine of the pollution in the snows is only 15-30% of the ethyl fluid value and exhibits the lower values further from the city center. These data support the interpretation that lead halide particles, formed initially by combustion of ethyl fluid in gasoline, suffer loss of Br by oxidation and volatilization. The smaller particles, because of greater surface area per unit mass, may suffer the most extensive bromine loss and may migrate farthest from the city center by virtue of their long atmospheric residence time. (Authors' Abs.)

(b) National Air Sampling Network (NASN)

778

AIR QUALITY DATA. NATIONAL AIR SAMPLING NETWORKS AND CONTRIBUTING STATE AND LOCAL NETWORKS.
Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1966, 126p.

The text tables summarize concentration data for the various pollutants for which detailed data are reported. Table A represents network-wide average and maximum concentrations of the suspended particulate and gaseous sampled for at the bi-weekly sampling stations, including comparable data gathered by state and local agencies. This publication is the first of what is planned as a series of annual summaries of all available air pollution data gathered by local, state, and national air sampling networks during the preceding calendar year. (APCA Abs.)

779

Blomquist, E. T.
A SUMMARY OF AIR SAMPLING STATIONS - 1966.
In: U. S. Congress. Senate. Committee on Public Works. Joint Hearings before the Subcommittee on Air and Water Pollution. 90th Congr. 1st Sess. May 15-18, 1967. Washington, D. C., U. S. Govt. Printing Office, n. d., p. 2240-2246.

Federal, state, and local non-continuous air sampling stations which were operated in 1966 are tabulated. The types of sampling stations include: (1) 24 hr suspended particulate; (2) 24 hr gaseous analysis by NASN; (3) lead peroxide sulfation rate, (one month); and (4) abatement branch effects network. (APTIC Abs.)

780

Heller, A. N., and S. G. Booras.
TELEMETERED AIR QUALITY NETWORK HELPS CHICAGO.
Environ. Sci. & Technol., v. 1: 984-990, Dec. 1967.

Twenty sampling sites were selected to provide a synoptic profile of the Chicago atmosphere. Sulfur dioxide, suspended particulates, and dustfall were measured. Sampling for suspended particulate concentrations consists of passing about 2400 m^3 of air through a 7-in. X 9-in. area of flash-fired glass mat filter in a 24-hrs period. The filters are weighed before and after the sampling. Filters are analyzed for concentrations of sulfate, nitrates, and metals. The West-Gaeke analytical procedure is used for SO_2. It consists of bubbling air through 20 ml of 0.10 N sodium tetrachloromercurate solution for 24 hrs. Dustfall measurements are made by collecting the settled material in glass jars containing 1-3 in. of water. A detailed summary of all suspended particulate data for 1966 is presented. A graphic summary of SO_2 data is plotted on a map of Chicago. Sampling of pollutants has indicated that meteorological factors play a significant role in concentration. Daily analysis of data reveals that the levels of pollutants vary inversely to wind speed. Heavier concentrations of pollutants are recorded with light wind speeds rather than with stronger winds. There is a very pronounced seasonal cycle of SO_2 in Chicago, indicative of a relationship with heating demands. Sulfur dioxide isopleth lines tend to parallel the lakeshore. The yearly average dustfall was 36.9 tons/mi^2/mo. The dustfall concentrations follow the pattern of density of population and industrial concentration as well as reflect seasonal variation. The air quality monitoring system consists of eight remote stations, each having a SO_2 analyzer and an aerovane. The system is designed for recording data at 15-min intervals by transmitting sequentially from each remote station to the central station. Data gathered at each remote site include SO_2 in ppms an integrated wind direction to the nearest degree, and an integrated wind speed to the nearest one tenth knot. Using computer techniques the stations are interrogated with a total transmissions time of 40 sec. The applications of the Telemetered Air Monitoring Network information are given. (APTIC Abs.)

781

Jutze, G. A., R. L. Harris, Jr., and M. Georgevich.
THE INTERSTATE AIR POLLUTION SURVEILLANCE PROGRAM EFFECTS NETWORK. Jour. Air Poll. Control Assoc., v. 17: 291-293, 1967.

A program has been designed to meet a nationwide intelligence-gathering responsibility to obtain general and relative information on current and potential air pollution in areas where interstate transport of pollution may reasonably be expected to exist. This paper describes the field devices utilized in the program. By means of these static "effects packages," data will be accumulated on: dustfall, particulate impingement, sulfation, corrosion, and tarnishing of metals, and deterioration of textiles, dyes, and rubber. Data accumulated during the "pilot phase" of the program will be discussed. (Authors' Abs.)

782

Larsen, R. I., C. E. Zimmer, D. A. Lynn, and others.
ANALYZING AIR POLLUTANT CONCENTRATION AND DOSAGE DATA. Jour. Air. Poll. Control Assoc., v. 17: 85-93, Feb. 1967.

Continuous air pollutant concentration data have been analyzed for CO, hydrocarbons, NO, NO_2, N oxides, oxidant, and SO_2 in Chicago, Cincinnati, Los Angeles, Philadelphia, San Francisco, and Washington for 1962 through 1964. Concentrations are approximately lognormally distributed for pollutants in all cities for averaging times. Maximum concentration is inversely proportional to averaging time to an exponent. Air pollutant dosage, concentration times time, above threshold concentrations has been computed for all of the pollutants in all of the cities for 1964. Equations have been developed from these analyses to predict the frequency of occurrence of air pollutant dosages of various intensities as a function of the geometric mean and standard geometric deviation. (APCA Abs.)

783

Lynn, D. A., and T. B. McMullen.
AIR POLLUTION IN SIX MAJOR U.S. CITIES AS MEASURED BY THE CONTINUOUS AIR MONITORING PROGRAM. Jour. Air Poll. Control Assoc., v. 16: 186-190, 1966.

Six gaseous pollutants were monitored in Cincinnati, Chicago, New Orleans, Philadelphia, San Francisco, and Washington, D. C. during 1962 and 1963. The data serve as a basis for describing several contrasts and similarities in the nature of air pollution experienced in 6 cities, which represent a broad geographical and climatological range of urban environments. Specific topics covered are: typical pollutant levels, patterns of daily and seasonal variations, and unusual phenomena such as atmospheric stagnation periods and photochemical smog formation. (Authors' Abs.)

784
McMullen, T. B., and R. Smith.
TREND OF SUSPENDED PARTICULATES IN URBAN AIR: 1957-1964. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1965, 28p.

The trend toward lower average concentrations of suspended particulate pollution in the urban air in the United States from 1957 through 1963, indicated by measurements of the National Air Sampling Network, is investigated from 3 aspects: (1) statistical significance, (2) the validity of the sampling and analytical methods, and (3) relation to environmental changes in the vicinity of the sampling stations. The evidence indicates that the decline is real and that the methods employed can reliably detect substantive changes in the concentration of suspended particulate pollution. Information on changes in the environments of a representative group of stations revealed that where significant decreases in suspended particulates occurred, they were often logically related to specific changes in source emissions. Thus, the indicated decline in the suspended particulate portion of urban air pollution is verified and substantially accounted for. A statistically significant increase in the annual mean occurred in 1964; if continued, such an increase would suggest the possibility of cyclic influences. (Chem. Abs.)

785
Morgan, G. B., C. Golden, and E. C. Tabor.
NEW AND IMPROVED PROCEDURES FOR GAS SAMPLING AND ANALYSIS IN THE NATIONAL AIR SAMPLING NETWORK. Jour. Air Poll. Control Assoc., v 17: 300-304, May 1967.

The NASN sampler for the collection og gaseous pollutants has been modified to increase its versatility and efficiency. Oxides of nitrogen are collected in bubblers employing a 70-100 μ frit with a collection efficiency of approximately 50% depending upon the frit porosity. Included in the sampler is a bubbler for the collection of aldehydes in which the aldehyde-MBTH complex is stable at least two weeks. This inert bubbler, which is constructed of polypropylene and Teflon, makes it possible for samples to be collected over the network and analyzed at a central laboratory. In addition, gaseous ammonia is collected in 0.1N H_2SO_4. This collecting system has an efficiency of greater than 85%. Low-level samples are analyzed automatically employing Nesslerization, whereas high-level samples from source emissions may be collected in indicating boric acid and titrated with 0.02N H_2SO_4. The sampler will accomodate either 50 or 100 ml polypropylene collecting tubes. (Authors' Abs.)

786
NATIONAL AIR SURVEILLANCE NETWORKS ANNUAL TABULATIONS - 1966. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, June 1967, 207p.

A complete tabulation is provided of 1966 NASN's data. The tabulations are arranged in alphabetical order by states and include suspended particulates, (141 Stations); (2) gas network, (52 Stations); and (3) lead candle network (Sulfation Rate), (24 Stations). No analysis of the data is presented. Analyses will be included in the Annual Report. (APTIC Abs.)

787
NATIONAL AIR SURVEILLANCE NETWORKS CONTINUOUS AIR MONITORING PROGRAM (1966 DATA TABULATIONS AND SUMMARIES FOR CHICAGO, CINCINNATI, DENVER, PHILADELPHIA, ST. LOUIS, AND WASHINGTON D. C.). Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1966, 551p.

The Continuous Air Monitoring Program is the National Air Surveillance Network which operates six continuous monitoring stations in major cities throughout the country. The data tabulations in this booklet are summaries of hourly concentrations of gaseous pollutants and 2-hourly summaries of soiling index levels during 1966. Also enclosed is a brief summary of monthly means and annual frequency distribution of data from all stations. (APTIC Abs.)

788
NATIONAL AIR SURVEILLANCE NETWORKS - FIRST QUARTER TABULATION 1967. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 217p.

The data obtained by the National Air Sampling Network (NASN) during the first quarter of 1967 are presented. The tabulations are arranged in alphabetical order by state and include data on suspended particulates, SO_2 and NO_2. (APTIC Abs.)

789
NATIONAL AIR SURVEILLANCE NETWORK. MIDYEAR REPORT. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 230p.

Tabulations of data obtained on samples collected at stations in the first half of 1967 are presented. The first quarter composite benzene soluble data have been added to the particulate table. The measurement of radioactivity was discontinued at the end of the first quarter as the low atmospheric levels do not justify the effort involved. Five gases (SO_2, NO_2, NH_3, aldehydes, oxidant) are currently being sampled at most of the gas network stations. The oxidant method currently being evaluated is based on the ferrous-ferric reaction. Sufficient data have not been collected to permit a valid comparison with the KI method which is most commonly used for oxidants. Lack of space has forced a discontinuation of the reporting of gas concentrations in both ppm and $/\mu g/m^3$, therefore in all future reports concentrations will be given in only ppms only. Parts per million can be converted to $\mu g/m^3$ by multiplying the observed ppm by the appropriate conversion factor: SO_2 - 2620, NO_2 - 1881, NH_3 - 695, aldehyde (HCHO) - 1227, total oxidant (as O_3) - 1963. During the second quarter 100% of the nonurban and 97.5% of the urban particulate sampling stations collected an adequate number of samples; 95% of the gas sampling stations performed satisfactorily and the sulfation rate network set a new high of 99% efficiency. (APTIC Abs.)

(c) Standards and Criteria

790

AIR QUALITY CRITERIA FOR SULFUR OXIDES. Washington, D. C., Public Health Service, National Center for Air Pollution Control, n. d., 260p.

The Clean Air Act of 1963 gave the Department of Health, Education, and Welfare authority to publish air quality criteria as guides for municipal, state, and interstate air pollution control authorities. These criteria establish the levels of concentration at which it is believed individual pollutants begin to harm our health and foul our environment. The criteria presented here offer guidelines for the abatement of air pollution involving sulfur oxides. It is the first in a series to be issued by the Department as guideposts for action on the major pollutants in our nation's atmosphere. Although the criteria presented index the effects of the oxides of sulfur, these effects do not necessarily, nor in fact actually, derive solely from the presence of sulfur oxides in the atmosphere. They are for the most part the effects observed when various concentrations of sulfur oxides, along with other pollutants, have been present in the atmosphere. Because of the interactions between pollutants and the reactions of the pollutants with oxygen and with water in the atmosphere, and because of the influence of sunlight and temperature on these reactions, the effects of one atmosphere polluted with oxides of sulfur may be quite different from the effects of another atmosphere similarly polluted with oxides of sulfur. The criteria presented here, then, are not exact expressions of cause and effect that have been replicated from laboratory to laboratory. Instead, the criteria are useful statements of the effects of the sulfur oxides in the atmosphere derived from a careful evaluation of what has so far been reported. As more studies of these effects expand our knowledge, the criteria will be modified accordingly. (APCA Abs.)

791

Blomquist, E. T.
FEDERAL ACTIVITY IN DEVELOPING AIR QUALITY CRITERIA. Jour. Air Poll. Control Assoc., v. 16: 530-531, 1966.

The program of the Division of Air Pollution for developing air quality criteria and the present state of preparation of documents covering criteria for two broad classes of contaminants - the oxides of sulfur and photochemical oxidants - is described. The preparation and content of these documents are briefly reported. (Biol. Abs.)

792

Gaulding, C. L.
DEFINITION OF AIR QUALITY CONTROL REGIONS. APPROACH AND EXPERIENCE TO DATE. Jour. Air Poll. Control Assoc., v. 18: 591-595, Sept. 1968.

Section 107. (a) (2) of the Clean Air Act, as amended by the Air Quality Act of 1967, directs the Secretary, HEW, to designate Air Quality Control Regions for the purpose of establishing ambient air quality standards required in subsequent sections of the Act. The Section stipulates that the Regions are to be designated on the basis of jurisdictional boundaries, urban-industrial concentrations, and other factors necessary to provide adequate implementation of air quality standards, and further that, to the extent feasible, the designations are to be completed within 18 months of enactment. In view of the direct impact that region designations will have on state and local control programs, this paper gives a status report on the steps taken by the National Air Pollution Control Administration to implement this Section in the 7 months since the Air Quality Act was signed. It discusses the procedural aspects of the Administration's approach, emphasizing Administration's policy and the involvement of state and local entities in the development of region designations. The designation of Air Quality Control Regions is related to other steps required by the Act, especially those involving state and local governments. (Author's Abs.)

793
Larsen, R. I.
DETERMINING SOURCE REDUCTION NEEDED TO MEET AIR QUALITY STANDARDS. Proc. 1st Internat. Clean Air Congr. London, England, Oct. 4-7, 1966. Ed. by A. Marsh, London, England, National Society for Clean Air, 1966, p. 60-64.

Ambient air quality standards were proposed and techniques for using these standards and pollutant concentration data to determine the source reduction necessary to comply with the standards are described. Concentration data can be used with air quality standards to calculate the over-all source reduction to meet the standard. The calculations can be refined to consider the effects of future growth, rural background concentrations, secondary pollutants from photochemical and other atmospheric interactions, and the contribution from each source or source type in a city. (APCA Abs.)

794
Larsen, R. I.
FUTURE AIR QUALITY STANDARDS AND INDUSTRIAL CONTROL REQUIREMENTS. In: Proc. Third Nat. Conf. Air Poll., Washington, D. C. 1966. Washington, D. C., Dept. of Health, Education and Welfare, 1967, p. 199-204.

General considerations in selecting ambient-air standards are discussed. This information can be used together with air quality measurements to determine the source strength reductions needed to meet various standards. The exposure times needed to produce various pollutant effects are discussed, calculation of pollutant control needed to meet a given standard is demonstrated, data is given on maximum concentration of metals, andfuture control requirements are predicted from calculations. (APTIC Abs.)

795
Lukacs, J., and A. T. Rossano.
AIR POLLUTION AND ITS CONTROL. Journal of Canadian Petroleum Technology (Montreal), v. 6: 23-26, Jan.-Mar. 1967. (Presented at: 17th Annual Tech. Meeting, Petrol. Soc. of CIM, Edmonton, Canada, May 1966)

The three basic criteria for atmospheric pollution (the source, the meteorological conditions, and the effects of pollution) are discussed. Natural and man-made sources of pollution are listed, and inversion is discussed as the most undesirable meteorological condition from an air pollution point of view. The estimated emissions of major contaminants in tons/day are tabulated for the cities of Calgary, Edmonton, Los Angeles County, Winnipeg, Pittsburgh and Philadelphia. It is estimated that annual loss from air pollution in the United States is 11 billion dollars. A program for air quality control is discussed. The basic approach should be: (1) evaluation of the local problem; (2) establishment of standards imposed on industry and the community on an equal basis; (3) establishment of an air resources management program; and (4) control of emission of pollutants. To accomplish this it is necessary to develop new methods to produce by-products from contaminants, more efficient processes in all phases of industry to minimize the amount of contaminants released into the atmosphere, and sound engineering analysis and design in air pollution control and studies. (APTIC Abs.)

796

McMullen, T. B., J. C. Fensterstock, R. B. Faoro, and others. AIR QUALITY AND CHARACTERISTIC COMMUNITY PARAMETERS. Jour. Air Poll. Control Assoc., v. 18: 545-549, Aug. 1968.

Statistical correlations between all pairs of 16 selected air quality measurements and 13 selected community parameters for 66 standard metropolitan statistical areas have been calculated, tested for significance, and reviewed for meaningful relationships. Some of the more meaningful relationships are presented in this paper. Of special interest are the correlations between the sulfate fraction of suspended particulate matter and the use of sulfur-containing fuels ($r = 0.66$), between ambient sulfur dioxide and the use of sulfur-containing fuels ($r = 0.85$), between the lead fraction of suspended particulates and annual purchases of gasoline ($r = 0.71$), and between vanadium in suspended particulates and the percent residual fuel oil used in a community ($r = 0.69$). Several of these relationships are given more definitive description with mathematical equations that describe how the ambient pollutant concentration varies as a function of a related community parameter. The geographic distribution of high and low pollutant levels is also discussed. (Authors' Abs.)

797

Middleton, J. T.
AIR QUALITY CRITERIA FOR SULFUR OXIDES. Washington, D. C., Public Health Service, National Center for Air Pollution Control, Mar. 1967. 133p.

A detailed study on sulfur oxides with emphasis on its effect on man and animals is presented. Physical and chemical properties, atmospheric reactions, sources, measures, and concentrations and variations of sulfur oxides are discussed in less detail than are the effects of air polluted with sulfur oxides on visual range, material and vegetation.

798

Stalker, W. W., and C. B. Robison.
METHOD FOR USING AIR POLLUTION MEASUREMENTS AND PUBLIC OPINION TO ESTABLISH AMBIENT AIR QUALITY STANDARDS. Jour. Air Poll. Control Assoc., v. 17: 142-144, Mar. 1967.

Air quality was comprehensively evaluated by means of sampling at 21 locations over metropolitan Birmingham, Ala, during a period of 1 year. Thousands of integrated samples of three atmospheric gaseous pollutants and two particulate pollutants were collected and analyzed. A random household survey was completed by conducting personal interviews at more than 7200 households. The relationship between ambient air quality and neighborhood opinion of air pollution effect on health and property are evaluated statistically. (Eng. Index)

X. LEGAL AND ADMINISTRATIVE ASPECTS

(a) Legislation

799

AUTOMOBILE STEAM ENGINE AND OTHER EXTERNAL COMBUSTION. In: U. S. Congress. Senate. Committee on Public Works. Joint Hearings before the Committee on Commerce and the Subcommittee on Air and Water Pollution of the Committee on Public Works. 90th Congr. 2nd Sess. May 27-28, 1968. Washington, D. C. U. S. Govt. Printing Office, 1968, 275p.

Some of the earlier problems with steam propulsion systems are discussed, as well as, specific advantages which steam engines might offer both in the emission of fewer pollutants and in improved performance and maintenance.

800

Bunyard, F. L., and J. D. Williams.
INTERSTATE AIR POLLUTION STUDY ST. LOUIS AREA AIR POLLUTANT EMISSIONS RELATED TO ACTUAL LAND USE. Jour. Air Poll. Control Assoc., v. 17: 215-219, 1967.

The Interstate Air Pollution Study of the St. Louis-East St. Louis Metropolitan Area conducted in 1963-1964, provided data for this report of air pollutant emissions related to three land-use categories: (1) residential, (2) institutional and commercial, and (3) industrial. A fourth land-use category, transportation and open space, is included in some calculations. The sources of pollutants considered are: power generation, both electric utilities and industrial, fuels used for space heating, solid waste disposal, and industrial processes. The pollutant emissions considered are particulates and sulfur oxides. Cumulative frequency distributions given are based on acres of land use and corresponding emissions per unit area. These frequency distributions-actual emission conditions that can be related to known air quality levels — provide a basis for performance standards and a guide for planners and others in future city developments, not only in St. Louis but in other similar cities as well. A suggested method for determining a different type performance zoning standard is presented. This standard is based on average conditions and thus would supplement, not replace, standards based on maximum allowable emissions. Calculations for such standards relating to St. Louis are presented. (Authors' Abs.)

801

A COMPILATION OF SELECTED AIR POLLUTION EMISSION CONTROL REGULATIONS AND ORDINANCES. Washington, D. C., Public Health Service, National Center for Air Pollution Control, 1968, 146p. (PHS Publ. No. 999-AP-43).

The regulations and ordinances (chosen as examples of the many types in use today) have been taken directly from the original text of individual state and local laws. The regulations and ordinances are arranged in such a manner that each section of the report is a compilation of laws pertaining to a specific type of pollutant or pollutant source. The sections included are: (1) smoke emissions and equivalent opacity regulations, (2) particulate emissions from fuel burning plants, (3) particulate emissions from refuse-burning equipment, (4) particulate emissions from manufacturing processes, (5) particulate emissions from asphalt batching plants, (6) sulfur compound emissions, (7) organic solvent emissions, (8) hydrocarbon emissions, (9) fluoride emissions, (10) motor vehicle emissions, (11) odor emissions, and (12) zoning ordinances.

802
Edelman, S.
THE LAW OF FEDERAL AIR POLLUTION CONTROL. Jour. Air Poll. Control Assoc., v. 16: 523-525, 1966.

The Clean Air Act, while recognizing the primary responsibility of states and local governments for the prevention and control of air pollution, provides authority for federal initiative and action to prevent and to abate air pollution which "endangers the health or welfare of any persons". The applicable statutory procedures and the scope of federal authority are analyzed and discussed. (Author's Abs.)

803
FEDERAL AIR POLLUTION R. & D. ON SULFUR OXIDES POLLUTION ABATEMENT. In: U. S. Congress. House. Committee on Government Operations. Hearings before Subcommittee. 90th Congr. 2nd. Sess. Sept. 5, 1968. Washington, D. C. U. S. Govt. Printing Office, 1968, 95p.

This hearing was primarily concerned with the following: (1) whether the Federal Research and Development Program is efficiently planned in terms of the present and future needs for new technology and (2) whether the program is coordinated in a manner that will effectively maximize use of the resources of all Federal agencies. Comprehensive papers on new sulfur oxide abatement technology are presented.

804
Goldsmith, J. R., L. Greenburg, A. P. Altshuller and others.
AIR POLLUTION AND HEALTH. A STATEMENT BY THE COMMITTEE ON AIR POLLUTION. Amer. Rev. Respiratory Diseases, v. 93: 303-312, 1966.

On many days of the year in many cities and towns throughout the country, the atmosphere is heavily contaminated with the exhaust from automobile engines, the discharged wastes of industrial processes, and the products of combustion resulting from the heating of homes and other buildings. The health effects of living in such an atmosphere have not been fully shown but it is known that at certain times, in heavily polluted atmospheres such as that occurring in London in 1952, persons became ill and died in numbers far in excess of those anticipated. In order to assess the health hazards of air pollution and to cope with them, it is necessary: to understand the conditions that give rise to a polluted atmosphere; to have reliable and valid techniques for measuring the presence and concentration of various pollutants individually and combined; and to assess the biologic effects of exposure to various forms and levels of air pollution on human organisms. (Authors' Abs.)

805

PROBLEMS OF AIR POLLUTION IN THE DISTRICT OF COLUMBIA. In: U. S. Congress. Senate. Committee on the District of Columbia. Joint Hearings before the Subcommittee on Business and Commerce and Subcommittee on Public Health, Education, Welfare and Safety. 90th Congr. 1st Sess. Mar. 8-16, 1967. Washington, D. C., U.S. Govt. Printing Office, 1967, 838p.

The hearings represent the most exhaustive treatise on the status of air pollution in the Nation's Capitol. All the possible aspects of the problem are discussed and commented on in the light of previously conducted major pertinent studies such as those made of the County of Los Angeles and the Chicago Metropolitan Area, respectively.

806

PROGRESS IN THE PREVENTION AND CONTROL OF AIR POLLUTION. First Report of the Secretary of Health, Education and Welfare to the United States Congress pursuant to Public Law 90-148: the Air Quality Act of 1967. (90th Congr. 2nd Sess., Senate. Document No. 92) Washington, D. C. U. S. Govt. Printing Office, 1968. 85p.

This is the first of a series of reports describing the progress being made in this country to prevent and control air pollution. Consideration is given to: (1) progress toward a regional approach to air pollution control, (2) progress toward effective control of air pollution (automotive air pollution stationary sources and surveillance), (3) additional research, and (4) supporting activities.

807

Rylander, R.

[MEDICAL CONSIDERATIONS IN AIR POLLUTION LEGISLATION]. Medicinska synpunkter på luftvårdslagstiftning. Nordisk Hygienisk Tidskrift (Köbenhavn) v. 46: 73-77, 1965.

Air quality standards can be divided into those relating to ambient air quality, emission and construction. Ambient air quality standards have been found to be most desirable from the medical point of view. To establish standards it is necessary to first define which type of deleterious effect on health one wants to prevent and then decide which portion of the population one primarily wants to protect. A survey of existing legislation from various countries shows that the above aspects have only been satisfied to a limited degree which has led to an incomplete protection in many cases. The development of standards must be performed by an expert committee including medical, technical and meteorological representatives. It is finally emphasized that from the medical point of view standards must be looked upon as guide lines rather than as unconditional demands when an individual air pollution problem is to be studied. (Author's Abs.)

808
Stern, A. C.
IMPLICATIONS OF THE AIR QUALITY ACT OF 1967.
Trans. New York Acad. Sci., v. 30: 759-765, Apr. 1968.

The Air Quality Act of 1967 is assessed. It incorporates the body of federal air pollution legislation that had developed from 1955 through 1966, setting a firm basis for the outgoing programs of research, training, technical, and financial assistance, and interstate and motor vehicle pollution abatement. It establishes a Presidential Air Quality Advisory Board. The implications of the requirements and limitations of the Act are reviewed. (Chem. Abs.)

(b) Administration and Abatement

809
AIR POLLUTION ABATEMENT ACTIVITY. PHASE II, PRE-CONFERENCE INVESTIGATIONS. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, Mar. 1968, 180p. (NCAPC Publ. No. APTD-68-1)

This report is based upon an investigation of air pollution conducted in the Kansas City area during 1966 and 1967. The sources, characteristics, concentrations, and interstate movement of air pollution that might affect health and welfare in the Kansas City area are discussed. Recommendations for the development of an effective program for abatement and prevention of air pollution in the area are presented.

810
AIR RESOURCE MANAGEMENT PROGRAM FOR SOUTHWESTERN OHIO-NORTHERN KENTUCKY. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, Mar. 1967, 43p.

The Southwestern Ohio - Northern Kentucky (SWO-NK) Air Pollution Survey group was organized to prepare a plan for an air resource management program for the SWO-NK region. This has been done by the Technical Committee, the working group appointed by the Executive Committee of the Survey. The program proposed herein represents a majority view of the 12 state and local governmental agency representatives composing the Technical Committee, but does not necessarily indicate acceptance in full by all such representatives. (Air Poll. Abs.)

811
Griswold, S. S.
COORDINATING REGIONAL OPERATIONS: AIR POLLUTION. Arch. Environ. Health, v. 16: 93-97, Jan. 1968.

Environmental health poses multidimensional problems. There are no single effective interstate programs to combat air pollution. A review of the New York-New Jersey metropolitan area interstate air pollution abatement conference is presented which includes their objectives and scope. Details of their air sampling network and the results are discussed. It is concluded on the basis of the New York-New Jersey abatement action that: (1) regional operations must be coordinated through an organizational entity whose responsibility and authority is not limited by political boundaries, (2) regional coordination should ensure a more thorough melding of operational staff personnel and physical facilities to minimize autonomous action that can cause confusion, and (3) regional coordination should be initiated at the highest possible administrative or legislative level.

812
Gruber, C. W.
SOURCE INSPECTION, REGISTRATION, AND APPROVAL. In: Air Pollution V. II. Analysis, Monitoring, and Surveying. Ed. by A. C. Stern. New York, Academic Press, 1968, p. 561-595.

Training, equipment, and transportation and communication are necessary for source inspection. Official control agency personnel conduct source inspections to: (1) act on a violation, (2) meet requirements of the air pollution ordnance, (3) investigate air pollution nuisance complaints, or (4) gather information on source strength to create an emission inventory. Source inspections are also made for the guidance of owners or managers and is made by them, their employees or consultants to: (1) determine their compliance with air pollution statutes and establish procedures to minimize emissions, (2) furnish information required by the regulatory agency, (3) develop the technical information necessary to apply control equipment and methods, (4) investigate nuisance complaints, and (5) develop legal defense. Illustative forms for inspections and details on how inspections are to be conducted are included.

813
GUIDE TO RESEARCH IN AIR POLLUTION: PROJECTS ACTIVE IN CALENDAR YEAR 1966. Washington, D. C., Public Health Service, Division of Air Pollution, 1966, 82p. (PHS Publ. No. 981)

The guide is divided into four sections: (1) the status of air pollution research as a whole, (2) a list of individual projects under investigation during the year, (3) index of these projects by subject, and (4) index by investigator. (Air Poll. Abs.)

814
Heller, A. N., J. J. Schueneman, and J. D. Williams. THE AIR RESOURCE MANAGEMENT CONCEPT. Jour. Air Poll. Control Assoc., v. 16: 307-309, 1966.

The air resource management concept is defined and delineated. Existing successful urban air resource management programs are described. The federal role in this development is briefly noted. The broad or essential keys to a successful program involve the development of an active policy on air conservation, a dynamic organization with active support by top management, and the use of long-range planning by the program director to attain the community's realistic goals for air quality. (Authors' Abs.)

815
Ingram, W. T., C. Simon, and J. R. McCarroll. AIR RESEARCH MONITORING STATION SYSTEM. In: Proc. Amer. Soc. Civil Eng., Jour. Sanitary Eng. Div., v. 93: 21-31, Apr. 1967. (Presented at: Nat. Symposium Sanitary Eng. Res., Develop., and Design, Penn. State Univ., University Park, July 1965.)

The Research Division of New York University (NYU) School of Engineering and Science in cooperation with Cornell University Medical College has established a continuous 24-hr monitoring station, the Christodora Station, in the center of an epidemiological study area in New York City to serve as a major exposures reference. The monitoring station has equipment for determining the following pollutants: total sulphation (Davis) SO_2, total hydrocarbons, CO, total oxidants, NO_2 total sulphation (lead candle), and particulate density (smoke shade). The Christodora Station staff of six members maintains the station equipment, conducts field studies, takes data, reduces data, and prepares information for computer memory systems. The data from this station are reduced to hourly averages with the exception of particulate density which is a 2-hr average. Comparison between levels of pollution at various locations are in progress. Since the establishment of the Christodora Station, New York has experienced three pollution episodes of special note. The first of these occurred between November 29 and December 4, 1962. The second episode began to build after October 10, 1963, and extended as an episode period from about October 13 to 25, the more intense period being from October 19 through 24. The third episode was relatively short in duration and high in intensity. The incident was associated with anticyclonic circulation and low wind speeds. Stagnation occurred only during the night of March 3 and of March 4. The operating budget for monitoring the station and handling data has been above 50,000 dollars per yr. (APTIC Abs.)

816
Larsen, R. I.
DETERMINING REDUCED-EMISSION GOALS NEEDED TO ACHIEVE AIR QUALITY GOALS... A HYPOTHETICAL CASE.
Jour. Air Poll. Control Assoc., v. 17: 823-829, Dec. 1967.

Air management steps involved in determining reduced-emission goals are enumerated, and the various decisions and actions involved in determining a set of goals for stationary and mobile combustion sources are illustrated by the actions of a hypothetical air-management board. (Abs. Refining Lit.)

817
Larsen, R. I.
HOW COMPUTERS AID AIR MANAGEMENT.
Jour. Air Poll. Control Assoc., v. 17: 439-445, July 1967.

The data system unit operations (sense, convert, encode, transmit, write, read, translate, sort, store, retrieve, and compute) are described. Examples are cited of how these unit operations have been combined into various operating systems to aid the dozen steps involved in air management. (Author's Abs.)

818
Lieber, H.
CONTROLLING METROPOLITAN POLLUTION THROUGH REGIONAL AIRSHEDS: ADMINISTRATIVE REQUIREMENTS AND POLITICAL PROBLEMS. Jour. Air Poll. Control Assoc., v. 18: 84-93, Feb. 1968.

This is an evaluation of the regional approach to controlling air pollution, in the light of the New York metropolitan experience, and recent federal and state legislative developments. Regional airsheds are defined and their administrative advantages delineated. The political difficulties involved in establishing and managing regional control districts, such as jurisdictional and regulatory problems, are also discussed. This paper touches upon the extent and adequacy of present day coordination and cooperation between agencies in the New York metropolitan area, as illustrated by the failure of the alert system during the Thanksgiving 1966 air pollution "episode." The conflicting approaches of regional air quality commissions and the Mid-Atlantic States Air Pollution Control Compact are stressed. The desirability of such federal and state legislative proposals, and the advantages and drawbacks of special districts and other institutional arrangements to solve regional problems are also evaluated. (Author's Abs.)

819
Loquerics, P., and W. J. Stanley.
AIR POLLUTION MANUAL OF CODING. Washington, D. C. Public Health Service, National Center for Air Pollution Control, 1968, 64p.

To enable proper decisions regarding "planning" or promoting necessary legislation for air pollution abatement, data must be well organized to provide optimum usefulness. Organizing the data manually became an almost impossible task. Computer correlations were required to obtain maximum usefulness from the information, which necessitated that a complete code be devised to translate the concepts to a machine handable form. This manual provides in Part I a listing of some of the industrial activities by their Standard Industrial Classification number and equipment associated with the air pollution sources found in that activity and in Part II the code numbers assigned to the equipment are illustrated.

820
Ludwig, J. H.
STATUS OF CURRENT TECHNOLOGY IN THE CONTROL OF EMISSIONS TO THE ATMOSPHERE. In: U. S. Congress. Senate. Committee on Public Works. Hearings before the Subcommittee on Air and Water Pollution. 90th Congr. 1st Sess. May 15-18, 1967. Washington, D. C., U. S. Govt. Printing Office, n. d., p. 2274-2277.

A tabulation is presented of the status of control technology for a wide range of industries. An indication is given of the presence or absence of control technology for particulate, sulfur oxidant, CO, and other pullutants. Remarks are provided regarding the difficulty or necessity of control for the various pollutants in the various industries. (APTIC Abs.)

821
Ludwig, J. H., and R. A. McCormick.
THE METEOROLOGY PROGRAM OF THE NATIONAL CENTER FOR AIR POLLUTION CONTROL. Bull. Amer. Meteorol. Soc., v. 49: 823-829, Aug. 1968.

The role of meteorologists in air pollution control has been enhanced greatly by the Air Quality Act of 1967. The demands of the Act will require the cooperation of many segments of the meteorological profession — government, university, and private — and will provide challenges that must be met to implement a truly effective program for restoring adequate quality of air to our nation. The NACPC will provide leadership, personnel, and training programs to implement the Air Quality Act of 1967. This will be in addition to their already broad research activities and other support functions. (Chem. Abs.)

822
MacKenzie, V. G.
DEVELOPMENT OF GOVERNMENTAL PROGRAMS OF IMPROVED AIR QUALITY. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, Apr. 28, 1966. Ed. by E. R. Hendrickson. DeLand, Fla., E. O. Painter Printing Co., n.d., p. 29-34.

The three principle facts which have a strong bearing on the challenge facing those broad segments of our society which have an important role to play in air pollution (including industry, government at all levels, the scientific community and the public) are discussed. These three principle facts are:

(1) there must be greatly augmented control efforts if the problem of air pollution is not to become critical, (2) greatly improved means of meeting the challenge must be provided, and (3) greater response by local and state governments and by industry is necessary

823

Megonnell, W. H.
DEVELOPING ABATEMENT POLICIES UNDER THE CLEAN AIR ACT. Jour. Air Poll. Control Assoc., v. 16: 254-256, 1966.

At the beginning of the federal program in 1955, air pollution was viewed as a technical challenge. While technical problems remain, emphasis is shifting toward the social challenge. The degree of federal assistance now available to states and municipalities, under the Clean Air Act is of broadened scope and higher order to magnitude; it is not confined to technical considerations, but has been expanded to take cognizance of political and economic obstacles that often block the path toward better air pollution control. (Author's Abs.)

824

Megonnel, W. H., and S. S. Griswold.
FEDERAL AIR POLLUTION PREVENTION AND ABATEMENT RESPONSIBILITIES AND OPERATIONS. Jour. Air Poll. Control Assoc., v. 16: 526-529, 1966.

The direct federal role in air pollution control was expanded and intensified by the 89th Congress to include authority for: (1) abatement of international pollution, (2) promulgation and enforcement of regulations regarding emissions from new motor vehicles and engines, and (3) the conduct of conferences and formulation of advisory recommendations concerning potential air pollution of substantial significance. Experiences under interstate abatement authorities of the Clean Air Act and plans for future activities under the new authorities are discussed. (Authors' Abs.)

825

Purdom, P.
ADMINISTRATION OF ENVIRONMENTAL HEALTH PROGRAMS WITHIN THE STATE GOVERNMENT: III. ADMINISTRATION OF AIR POLLUTION CONTROL PROGRAMS WITHIN THE STATE GOVERNMENT. Amer. Jour. Public Health, v. 57: 281-286, 1967.

The Air Hygiene Committee of APHA [American Public Health Association] suggested in 1960 that control of polluting emissions be accomplished at the lowest level of government capable of effective action. Practice in states vary from Arkansas, where the state laws prohibit local air pollution control agencies, to other states, such as Colorado and Ohio, where authority to control sources of air pollution is vested in cities and counties. Several state programs are described to illustrate administrative arrangements. In California, the state is responsible for motor vehicles and local government is responsible for other pollution sources. New Jersey is highly centralized at state level. New York has an integrated state-local system with the state sharing local program costs directly. Ohio provides tax incentives. Pennsylvania has a unique system of regional associations under state auspices. Administration is discussed with respect to formulation of objectives, analysis of needs, programs of services and organization. (Biol. Abs.)

826

Purdom, P. W., H. C. Wohlers, and W. E. Jackson.
AIR QUALITY AND SOURCE EMISSIONS. In: Proc. Amer. Soc. Civil Eng., Jour. Sanitary Eng. Div., v. 93: 97-103, Dec. 1967.

The use of air quality criteria as a guide for community action and especially for long-term community planning, is presented. The emphasis on shifted from abatement to prevention of excessive pollution, with attention directed to the source and the efficiency of control systems. The performance to be obtained from the control system was a matter of negotiation between community and those responsible for the source. Certain efficiencies usually obtainable with well known types of processing equipment or control devices became accepted as good practice, and emission standards based on these practices were incorporated into regulations. (Eng. Index)

827

REPORT FOR CONSULTATION ON THE METROPOLITAN DENVER AIR QUALITY CONTROL REGION. Washington, D. C., Public Health Service, National Air Pollution Control Administration, Oct. 1968, 80p.

In conjunction with the Air Quality Contrcl Act of 1967 concerning "air quality control regions" this report was prepared. This report is to serve as background material for the consultation meeting designating a Metropolitan Denver Air Quality Control Region. A region is proposed and discussed and an evaluation of the urban and engineering factors presented. An emission inventory and diffusion model description are also included.

828
Rydell, C. P., and G. Schwarz.
AIR POLLUTION AND URBAN FORM: A REVIEW OF CURRENT LITERATURE. Jour. Amer. Inst. Planners: v. 34: [1-6] Mar. 1968.

An urban air pollution problem is caused by the overall spatial and temporal arrangement of the urban elements (smoke stacks and automobiles) causing the pollution. The designing of buildings and streets, the location of industrial sites, the transportation of people and goods, the allocation of open space, the planning of land use, and the planning of air use are discussed in order to alleviate or minimize the contributions of city structure to air pollution.

829
Sableski, J. J.
THE FEDERAL AIR POLLUTION CONTROL PROGRAM AS IT RELATES TO THE KRAFT PULPING INDUSTRY. TAPPI, v. 50: 35A-39A, Aug. 1967.

The federal air pollution program as it relates to the kraft pulping industry, with particular emphasis on the odorous character of the industry's atmospheric emissions, is described in terms of 4 individual federal activities: (1) research, (2) grants-in-aid, (3) technical assistance, and (4) abatement actions. (Author's Abs.)

830
Schueneman, J. J.
LOCAL, REGIONAL, AND STATE AIR POLLUTION CONTROL. In: Proc. Amer. Soc. Civil Eng., Jour. Sanitary Eng. Div., v. 93: 65-71, Dec. 1967.

Some aspects of governmental agencies concerned with the regulation of air pollution are presented. The activities of these agencies are usually referred to as air pollution control, air quality control, air resource management, or air conservation programs. The basic objective of these programs is to ensure that the health of the public will not be adversely affected by air pollution. Other objectives are the prevention of detrimental effects on public welfare: the protection of plant and animal life; the prevention of soiling and damage to property, and of interference with its use and enjoyment; the provision of visibility requirements for safe air and ground transportation, the assurance of continued community economic growth; and the maintenance of an aesthetically acceptable and enjoyable environment. Elements of air resource management programs, city, county, and regional air pollution control programs, the activities of state programs, and Federal activities affecting state and local programs are discussed. (APTIC Abs.)

831
Smith, R. G.
MAJOR FACTORS IN AEROSPACE PLANNING AND DECISION. George Washington Univ., Washington, D. C., 1966, 184p. (NASA Accession No. N66-30756) (Report No. NASA-CR-76298)

An analysis of economic, technical, and sociopolitical factors considered by aerospace industry managers in their long-range planning and decision-making functions was conducted, to focus attention on the interdisciplinary aspects of the space-age planning process. Personal contact was made with managers of various government agencies and aerospace companies to determine management's role in decision making. There is no universally acceptable planning format for all companies in all situations. It is intended that this analysis offer general insight into the challenges and problems facing aerospace industry managers. (Chem. Abs.)

832
Spaite, P. W.
FEDERAL AIR POLLUTION PROGRAM: READY TO FINANCE MORE OUTSIDE HELP. Chem. Eng., v. 75: 170-172, Jan. 1968.

Some of the programs being carried out by the U. S. National Center for Air Pollution Control for the control of sulfur pollution produced in the combustion of fossil fuels, with emphasis on coal, are discussed. (Abs. Refining Lit.)

833
Spaite, P. W.
THE FEDERAL PROGRAM OF ENGINEERING RESEARCH AND DEVELOPMENT FOR SULFUR POLLUTION CONTROL. In: Proc. MECAR Symposium New Developments in Air Pollution Control, New York, Oct. 23, 1967. Ed. by R. A. Fox. New York, Metropolitan Engineers Council on Air Resources, 1967, p. 62-69.

The Public Health Service began air pollution engineering research and development in 1957. Present and projected programs are described with respect to both subject matter of the research and relative roles foreseen for participating groups in and out of government. The Federal engineering work on sulfur oxide control is and will continue to be conducted largely under contracts with private organizations and the program is designed to fill gaps left by the increasing volume of work that is privately supported. The National Center for Air Pollution Control's engineering research and development work on the sulfur oxide problem is directed toward three goals: (1) demonstration and large-scale prototype studies of a number of processes that are candidates for control of sulfur oxides from power generation; (2) an intensive search for new sulfur control processes having long-range potential greater than that of the "first generation" of processes to be studied on large-scale equipment; (3) a program to develop control methods for sulfur emissions from sources other than combustion of fossil fuels. The program of new process development launched in 1967 is aimed primarily at providing second-generation processes for removing the SO_2 from flue gases. Two types of contracts are being negotiated. One series will be devoted to thorough, broad surveys of presently available technology in nine areas; aqueous solution, dry metal oxide sorption, direct reduction to sulfur, inorganic liquids, organic solids, and physical separation. The second area of support encompasses solids, and physical separation. The second area of support encompasses a series of unsolicited proposals. (APTIC Abs.)

834
Stanley, W. J.
AIR RESOURCE MANAGEMENT IN THE CHICAGO METROPOLITAN AREA PLANNING FOR CLEAN AIR. Presented at: Internat. Clean Air Congress, London (England) Oct. 1966.

The many facets that were helpful in designing and implementing the City of Chicago's Five-Year Air Resource Management Programme and the progress to date are explored. Existing control programs are reviewed and attention is devoted to the methodology used to develop a successful air resource management program.

835
Stanley, W. J.
THE ROLE OF THE COMPUTER IN AIR POLLUTION CONTROL. Jour. Air Poll. Control Assoc., v. 16: 100-101, Feb. 1966.

A brief description is given of the historical development of Chicago's Department of Air Pollution Control, and how the growth of urban population and industrialization have dictated the needs for rapid analyzation and reporting of accurate, precise information to deal effectively with one of the nation's most important urban problems. How the computer can be effectively utilized in a systems and data processing program to solve these problems, thus providing more time for professional and technical personnel to devote to investigation and enforcement of the ordinance of a huge municipality is described. In addition, how the federal government and a local municipality can co-operate in the solution of a mutual problem affecting the health and economy of our nation is demonstrated. (Biol. Abs.)

836
Stanley, W. J., and D. D. Cranshaw.
THE USE OF A COMPUTER-BASED TOTAL MANAGEMENT INFORMATION SYSTEM TO SUPPORT AN AIR RESOURCE MANAGEMENT PROGRAM. Jour. Air Poll. Control Assoc., v. 18: 158-160, Mar. 1968.

This paper discusses how Chicago is leading the way in the use of computer technology to implement a Total Management Information System in support of its Air Resource Management Program. Included in this description of Chicago's Dynamic Program is the conceptual design of the On-Line Real-Time System utilizing third generation equipment. (Authors' Abs.)

837
Sterling, T. D., and S. V. Pollack.
ROLE OF STATISTICS IN THE WORLD OF COMPUTERS. Ann. New York Acad. Sci., v. 128: 1108-1116, Jan. 1966. (Presented at: Conf. on Advances in Biomedical Computer Applications, June 3-5, 1965).

The very strong points of statistical procedures stand now in conflict with the sort of possibilities for data processing that have been opened to science through automation and computers. The fundamental sources of the conflict are described and some predictions are made as to the restrictions and changes in the use of statistics in future biological work. (Authors' Abs.)

838
WASHINGTON, D. C., METROPOLITAN AREA AIR POLLUTION ABATEMENT ACTIVITY. Cincinnati, Ohio, Public Health Serbice, National Center for Air Pollution Control, Nov. 1967, [212]p.

From February 1967 to August 1967 the Public Health Service conducted a technical investigation in the Washington, D. C. metropolitan area to provide information that could form a basis for recommendations for abatement in accordance with the tenets of the Clean Air Act. The results are presented of the 1967 investigation and the methods, techniques, and procedures are described. In concert with cooperative regional and local aspects, an air quality network was established, an emissions inventory was conducted, estensive meteorological data were acquired, air pollution effects on vegetation and various materials were investigated, and special data processing and summarization techniques were developed. The boundaries for the activity conformed to the Metropolitan Washington Council of Governments' area which includes the District of Columbia; the Maryland counties of Montgomery and Prince Georges; the Virginia counties of Arlington, Fairfax, Loudoun, and Prince William; and the independent cities of Alexandria, Falls Church, and Fairfax. (APTIC Abs.)

839
Williams, J. D.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: VI EFFECTS OF AIR POLLUTION. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, Dec. 1966, 62p.

In this report of a survey in the St. Louis metropolitan area sections are devoted to the following: (1) methods available for setting air quality goals, (2) deleterious effects of sulphur oxides, H_2S, CO, oxidants and particulate matter, (3) odors, (4) effects on asthma sufferers, (5) aeroallergens, (6) deterioration of steel, nylon and cotton fabrics, (7) vegetation damage, (8) effects of air pollution on property values, (9) public opinion survey, (10) summary of effects on human health and, (11) summary of economic effects. (Air Poll. Abs.)

840
Williams, J. D., F. J. Roland, and F. L. Bunyard.
METROPOLITAN PLANNING PROGRAM RELATIONSHIPS TO AIR RESOURCE MANAGEMENT. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, Dec. 1966, 15p.

After a short introduction and an explanation of the concept of air resource management the following activities are described: (1) air quality goals, (2) emissions inventories, (3) transport of air pollutants, and (4) air quality monitoring. A brief description is then given of systems and tools used to co-ordinate air resource management requirements and of planning applications of air resource management. (Air Poll. Abs.)

841
Williams, T. F.
SOURCES AND POLLUTANTS THAT ENDANGER HEALTH AND WELFARE TO BE CONSIDERED FOR THE FEDERAL EMISSION STANDARDS. In: U. S. Congress. Senate. Committee on Public Works. Hearings before the Subcommittee on Air and Water Pollution. 90th Congr. 1st Sess. May 15-18, 1967, Washington, D. C., U. S. Govt. Printing Office, n. d., p. 2531-2535.

Experimental exposure of humans to SO_2 is briefly reviewed. Thresholds for the detection of SO_2 by taste and odor, and thresholds which cause alterations in respiratory function are given. Tables are included showing SO_2 concentrations at CAMP sites for 1962-1964, and threshold concentrations of SO_2, H_2SO_4, and their combinations, for various reflex response. (APTIC Abs.)

842
Yaffe, C. D., and W. F. Johnson.
MEASURING THE IMPROVEMENTS IN THE CONTROL ASPECTS OF [AIR POLLUTION] PROGRAMS AIDED BY FEDERAL GRANTS. Jour. Air Poll. Control Assoc., v. 17: 316-318, 1967.

Ambient air standards, emission standards, and program activities are considered in a search for appropriate indices for measuring program progress and effectiveness. Such indices can best be based on data related to weight of emissions. Several methods for expression accomplishment are presented for consideration. (Biol. Abs.)

Zimmer, C. E., and G. J. Nehls.
THE IMPACT OF COMPUTERS UPON AIR POLLUTION RESEARCH. Jour. Air Poll. Control Assoc., v. 18: 383-386, July 1968.

The electronic computer has had a profound effect upon air pollution research activities. This paper discusses some of the ways in which Public Health Service scientists routinely make use of the computer. It is used as a data processor to handle the large volumes of data resulting from continuous air monitoring devices. More importantly, it is used to perform the very complex computations involved in various statistical analyses and mathematical model building. In future years computers may be used on a real-time basis to control the sources which emit pollutants to the atmosphere. (Authors' Abs.)

844
BULLETIN OF COURSES JULY 1967 THROUGH JUNE 1968. TRAINING PROGRAM NATIONAL CENTER FOR AIR POLLUTION CONTROL. Washington, D. C. U. S. Public Health Service, Bureau of Disease Prevention and Environmental Control, n. d., 31p.

Information is presented on the training program of the National Center for Air Pollution Control. The support of long-term training, NCAPC regional offices, related training programs, levels of learning, causes and their descriptions, and a schedule of courses is presented.

845
Cederlof, R.
URBAN FACTOR AND PREVALENCE OF RESPIRATORY SYMPTOMS AND "ANGINA PECTORIS". Arch. Environ. Health, v. 13: 743-748, 1966.

The investigation was performed to elucidate whether urban and rural population groups differ in regard to the prevalence rate of angina pectoris, cough, and bronchitis and, if so, whether these differences can be explained by group incompatibilities with regard to constitutional factors or smoking habits or both. The investigation was based on a population of Swedish same-sex twins born between 1886-1925, provided that both twins in each couple were still alive and living within the country at the time of compilation (1961-1962). Information about the twins zygosity, smoking habits, residential history, and certain symptoms was obtained with the aid of mailed questionnaires. The prevalence of angina pectoris was higher among smoking men in urban than in rural areas, as judged on the basis of the population sample. This hypermorbidity was less apparent in the analyses according to the twin-control method. The prevalence of the respiratory symptoms was higher among smoking men in urban than in rural areas, as judged on the basis of the population sample as well as on the analyses of the twin pairs (twin-control method). The study does not reveal what constituent in the urban factor is the causative agent; air pollution must be suspected. (Author's Abs.)

846
Cederlof, R., L. Friberg, and E. Jonsson.
THE EPIDEMIOLOGICAL APPROACH IN ESTIMATING MAC [MAXIMUM ALLOWABLE CONCENTRATIONS] VALUES WITH SPECIAL REFERENCE TO MEDICO-SOCIOLOGICAL AND STATISTICAL METHODOLOGY. Nordisk Hygienisk Tidskrift (Köbenhavn), v. 46: 33-43, 1965.

An interview approach to determine statistically the response of individuals to air pollution is described. The method attempts to avoid bias in the interviewee (exaggeration of physical effects of pollution, etc.), by a variety of refinements of the interview technique. Data are presented in graphs, charts, and tables. (Biol. Abs.)

847
Crowe, M. J.
TOWARD A "DEFINITIONAL MODEL" OF PUBLIC PERCEPTIONS OF AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 18: 154-157, Mar. 1968. (Presented at: 60th Annual Meeting, Air Poll. Control Assoc., Cleveland, Ohio, June 12-16, 1967. Paper No. 67-68).

From a public attitudinal survey conducted in a city in Southwest Pennsylvania, different levels or aspects of public perceptions of air pollution are suggested. This "model" of public definitions of air pollution was analyzed in terms of selected social characteristics such as education, socioeconomic status, sex, residence, etc., in the attempt to isolate factors that may influence a person's perception of air pollution. The definition of air pollution involves a whole host of factors, but it appears that level of education, socioeconomic status, and residence have the most influence in terms of the various meanings attached to air pollution. Modification and clarification of the model through further research may enable more insight of public awareness and concern with air pollution as an urban problem. (Author's Abs.)

848
DeGroot, I.
TRENDS IN PUBLIC ATTITUDES TOWARD AIR POLLUTION. Jour. Air Poll. Control Assoc., v. 17: 679-681, Oct. 1967.

An attempt is made to bring together the findings relative to people's attitudes about air pollution from a series of studies conducted by or for the U.S. Public Health Service. Trends are traced. These findings are presented in the light of planning for the implementation of air pollution abatement measures and probable public reactions to them. Further research needs are pointed out. Special emphasis is placed on the control officer's needs for this type of information, its derivation, and its possible use in programming. (Author's Abs.)

849
Gartner, I.
STAFF SALARIES IN POLLUTION CONTROL AGENCIES. Jour. Air Poll. Control Assoc., v. 18: 579-585, Sept. 1968.

Based on the author's nationwide survey of salaries in mid-1967 from 118 state and local APC agencies with 1668 positions, this paper comparatively analyzes the results with pertinent occupations in major national salary surveys by the Bureau of Labor Statistics, National Science Foundation, the National Society of Professional Engineers, and College Placement Council. This baseline comparative investigation indicates agency salaries are significantly lower than pay levels of the competition in today's labor market. These conditions are compounded by the disadvantage of comparatively small organizational size with consequent limitations on individual opportunities for growth and recognition. Salary setting recommendations for jobs unique to government, and other possibilities of coping with the poor competitive situation (for recruiting, retaining, and motivating manpower) are presented. (Author's Abs.)

850
Heller, A. N.
METHODS OF EVALUATING SOCIOECONOMIC EFFECTS IN AIR POLLUTION. In: Proc. Internat. Conf. on Atmospheric Emissions from Sulfate Pulping, Sanibel Island, April 28, 1966. Ed. by E. R. Hendrickson, DeLand, Fla., E. O. Painter Printing Co., N.d., p. 141-156.

Air pollution affects the interaction between human beings and their environment. An opinion survey used to study public attitudes towards air pollution is presented. The questionnaire, sample selection and composition, interview situation structure, and survey results are explained. The analysis of the economic aspects is also explained.

851
Johnson, K. L.
CITIZEN COMPLAINTS OF AIR POLLUTION IN NORTHEASTERN ILLINOIS. Jour. Air Poll. Control Assoc., v. 18: 399-400, June 1968.

In 1964, as part of the Northeastern Illinois Metropolitan Planning Commission's Air Resource Management Study, an examination was made of citizen complaints of air pollution registered with air pollution control agencies representing the City of Chicago, outlying Cook County, and the State of Illinois. The complaint files of the City of Chicago were found to contain the addresses of some 9500 air pollution sources specified by complaints in complaints covering the time period from approximately 1954 to 1964. A statistical sample of these sources showed more than 70% to be of a nonindustrial nature, with domestic fuel burning or incineration by neighbors most often specified. There were 1119 industrial process sources named in the Chicago files; 588 nonmanufacturing and 531 manufacturing. Fabricated metal industries, primary metal industries, chemical manufacturers, and food processing plants were cited more often than other industrial categories. Complaint sources named in complaints filed by citizens with the State of Illinois, and with Cook County, differed with those of Chicago in that industrial sources were specified more often than nonindustrial ones. The reason for this is believed to lie in the reduced residential densities and the relatively great use of pollution-free fuels in the metropolitan area outside of the City of Chicago. (Author's Abs.)

852
Leduc, E. C., I. Gartner, J. Sacco and others.
MANPOWER POLICIES IN SELECTED AIR POLLUTION CONTROL AGENCIES. Jour. Air Poll. Control Assoc., v. 18: 211-214, Apr. 1968.

Selected personnel practices of air pollution control agencies in three urban areas of various sizes and in a state agency are examined. The analysis emphasizes the consequences of these personnel policies for each of the governments. (Authors' Abs.)

853
Megonnell, W. H.
AIR POLLUTION CONTROL: ITS IMPACT UPON MUNICIPALITIES, INDUSTRY, AND THE INDIVIDUAL. Air Eng., v. 9: 12-14, July 1967. (Presented at: Summer Conf. on the Demands of Pollution Control Legislation, Fairleigh Dickinson Univ., N. J., Aug. 26, 1966).

The contribution to air pollution by the individual citizen and his financial involvement in abatement and control are discussed. Direct and indirect costs of pollution abatement regulations to the individual are illustrated. The impact of pollution control regulations on industry is examined. Industry's concern should be with the failure of the adoption of uniform regulations and universal enforcement thereof. The problems of sulfurous emissions, control measures, and costs involved are discussed. The responsibility of governing officials of municipalities to aid in pollution control is also discussed. Benefits of pollution prevention, control, and abatement are enumerated. (APTIC Abs.)

854
Perman, R.
EMERGING CONCEPTS OF AIR POLLUTION PROBLEMS, AS SEEN BY THE POLITICAL SCIENTIST. Jour. Air Poll. Control Assoc., v. 16: 532-535, 1966.

The political scientist has become increasingly interested in the problems posed by air pollution. His specialized approach to these problems has developed in several directions. Until recently, the principal interests of the political scientist were those of the metropolitan area-governmental unit complex, federal-state-local relationships, and the clash of factions and pressure groups in a pluralistic society. While these are still of importance and of interest, there is now emerging a viewpoint of air pollution as a problem associated with current political emphasis on improving the quality of American life, our society having reached a new plateau after dealing with such quantitative matters as economic security and full employment. There is also emerging an increased interest in application of economic yardsticks, such as cost-benefits ratio analyses, and indeveloping the economic motivation factor as elements in guiding political and administrative directions in control activity. (Author's Abs.)

855
Rossano, A. T., Jr., T. H. Moller, and H. T. Dalmat.
NATIONWIDE AIR POLLUTION CONTROL TRAINING EFFORTS: STATUS QUO VERSUS NEEDS. Jour. Air Poll. Control Assoc., v. 18: 180-182, Mar. 1968.

This paper briefly reviews the historical development of air pollution training activities in the U. S. It describes the various types of training programs currently available, such as short courses, specialized programs, and university training at the graduate level. The level of financial support and the number of individuals enrolled in these programs are discussed. The paper concludes with an outline of future needs in terms of changes in existing training programs, extension into new areas, and the critical problem of recruitment of qualified candidates for training. (Authors' Abs.)

856
Schueneman, J. J.
ORGANIZATIONAL AND OPERATIONAL TECHNIQUES FOR RELIEVING MANPOWER SHORTAGES IN AIR POLLUTION CONTROL AGENCIES. Jour. Air Poll. Control Assoc., v. 17: 670-672, Oct. 1967.

Techniques which may be used to relieve manpower shortage are discussed in terms of (1) collaboration between state and local agencies, (2) organizational structures which make maximum use of scarce categories of people, (3) program policies which conserve the time of agency staff, (4) operating schemes which save travel time and minimize the skills required; and (5) working tools that can be used to get greatest production with the available personnel. (Eng. Index)

857
Williams, J. D. and F. L. Bunyard.
INTERSTATE AIR POLLUTION STUDY: PHASE II PROJECT REPORT: VII OPINION SURVEYS AND AIR QUALITY STATISTICAL RELATIONSHIPS. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, May 1966, 39p.

Two types of report were used in this survey of the St. Louis metropolitan area; the first, a survey of public opinion, and the second, a survey of the opinions of public officials. A summary of each of these surveys is given. A third section of the report deals with a specialized use of the public opinion survey in which the results are related to chemical and physical measurements of air pollution. (Air Poll. Abs.)

XII. BASIC SCIENCE AND TECHNOLOGY

858
Achinger, W. C. and R. T. Shigehara.
A GUIDE FOR SELECTED SAMPLING METHODS FOR DIFFERENT SOURCE CONDITIONS. Jour. Air Poll. Control Assoc., v. 18: 605-609, Sept. 1968.

Present standardized methods (ASME Power Test Code 27, Western Precipitation Bulletin 50, etc.) of stack sampling usually stress sampling under conditions of steady flow (no variation with time) in order to obtain data representative of the source emissions. On many occasions these standardized methods are applied when the velocity and/or the mass flow rate of pollutants do vary with time, thus impairing the accuracy of sampling results. In addition, it is difficult to evaluate any inaccuracy of the sampling data. This paper classifies these two source variables into four categories and suggests basic sampling approaches for each type of source condition. Several standardized procedures are evaluated and classified according to the source conditions to which the procedure is applicable. The intent of this paper is to show the most accurate sampling approach for each source condition and thus serve as a guide when planning source sampling programs. (Authors' Abs.)

859
Booras, S. G., and C. E. Zimmer.
COMPARISON OF CONDUCTIVITY AND WEST-GAEKE ANALYSES FOR SULFUR DIOXIDE. Jour. Air Poll. Control Assoc., v. 18: 612-615, Sept. 1968.

A comparison of the two most common methods used by air pollution control agencies for the analyses of SO_2 is discussed in this paper. Samples were collected simultaneously (502 pairs) for an 8-mo period at eight sites in the City of Chicago, using the West-Gaeke and conductivity methods. These methods are analyzed statistically to ascertain the existence of a factor describing adequately any differences between methods. (Authors' Abs.)

860
Brewer, A. W., and A. W. Wilson.
THE REGIONS OF FORMATION OF ATMOSPHERIC OZONE. Quarterly Journal of the Royal Meteorological Society (London), v. 94: 249-265, July 1968.

The nature and magnitude of the source of the natural ozone of the atmosphere is discussed and the results of calculations of the local rates of production in the periods January-February and July-August are given. The effect of different assumptions and models on the deduced source regions and source strengths is demonstrated. It is concluded that the most satisfactory result is obtained using solar ultraviolet intensities recently measured in the stratosphere. It is possible that there may be some catalytic destruction of ozone by water vapor, but below 35 km the effect must be small. (Authors' Abs.)

861
Burleigh, J. R., C. L. Kramer, and T. I. Collins.
A SPORE SAMPLER FOR USE IN AIRCRAFT. Phytopathology, v. 547: 434-436, 1967.

To study dissemination of cereal rust spores, a volumetric spore sampler (the "aerospore sampler") for use in light aircraft was constructed. This device is a continuously operating slit-type sampler that utilizes a circular belt (38 cm in circumference) of clear 35-mm photographic film coated with a thin layer of silicone as the trapping surface. Two vacuum pumps pull air, at 1.5 ft^3/min, through a 20-mm diameter intake tube that is narrowed to a 1.45 x 14 mm slitlike opening. The film is advanced past the orifice by a spring wound clock motor at a constant rate of 25.4, 50.8, or 76.2 mm/hr, depending on the gears in use. A 35-mm camera body which serves as the film track holds the film in place 2 mm below the slit orifice. Film speed is correlated to ground speed of the aircraft to locate specific geographic areas on the film surface. This information coupled with ground surveys, enables the researcher to study the relation between rust severity and concentration of rust spores in the air. (Authors' Abs.)

862
Call, R. W., E. P. Palmer, and R. W. Grow.
MEASUREMENT OF ATMOSPHERIC AEROSOLS BY POLARIZED-LASER LIGHT SCATTERING. Univ. of Utah, Microwave Device and Physical Electronics Lab., Salt Lake City. June 1967, 127p. (PB-175688)

A new method of taking aerosol measurements using scattered light from a laser beam fired into the atmosphere was developed and tested. The method developed uses measurements of light scattered from a polarized laser beam to find the aerosol attenuation coefficient, the aerosol number density and the aerosol size distribution. The method was tested by making measurements from a secondary site distant from the laser transmitter. Results are plotted for attenuation coefficients up to 30 kilometer in altitude. Mie scattering functions, specifically for use with polarized light beams were computed for various aerosol size distributions. Theory is developed for making two-station backscatter measurements using a pulsed ruby laser as a light source. The Rayleigh and Mie scattering functions are applied to the geometry of the problem, and by considering the polarized properties of the laser beam a simplified scattering equation is developed. By taking two scattering measurements at any given altitude, using different angles of polarization of the laser beam for the separate measurements, troublesome variables are eliminated from the scattering equations. Effects of beam attenuation losses on the transmitting and scattered light paths were eliminated from the equation solution, as were constant involving receiver efficiency, transmitted power, beam divergence, etc. The final solution to the equation for aerosol attenuation coefficients depends only on the angular functions for Rayleigh and Mie scattering and upon the relative voltage responses at the distant receiver for the two separate measurements taken at each altitude. The calculations for any given altitude are independent of those for any other altitude. (APTIC Abs.)

863
Chass, R. L.
INSTRUMENT REQUIREMENTS FOR AIR AND SOURCE MONITORING. In: Symposium on Air Pollution Instrumentation, Los Angeles, Calif., Oct. 1965, Ed. by D. F. Adams. Pittsburgh, Pa., Instrumentation Society of America, 1966, p. 11-12.

The demand for air sampling instruments continues to increase. The instruments now available tend to be bulky, not very portable and relatively expensive. Progress in air pollution control is hindered by the lack of air sampling instruments to measure less popular but still important air contaminants. Samples and studies of the air pollution sources is a field barely surveyed which should not be passed over. Instruments to measure air pollution at the source should be developed.

864
Cheney, E. S., and M. L. Jensen.
CORRECTIONS TO CARBON ISOTOPIC DATA OF GULF COAST SALT-DOME CAP ROCK. Geochimica et Cosmochimica Acta (Oxford) v. 31: 1345-1346, 1967.

It is shown that Gulf Coast salt-dome cap rock has a mean of -36.2% and a sample standard deviation of 6.2%. On p. 1346, Cheney and Jensen's 1965 value for δ_{WS} should be - 47.9, not 19.4. Review of the revised data indicates that the difference in C isotope comparison between Gulf Coast cap rock and Sicilian Sulfur limestone remains statistically and geologically significant. (Chem. Abs.)

865
Cottingham, P. L., and H. C. Carpenter.
CATALYTIC GASIFICATION OF SHALE OIL. In: Fuel Gasification. Ed. by R. F. Gould. Washington, D. C. Amer. Chem. Soc., 1967, p. 180-189. (Symposium sponsored by the Div. of Fuel Chem. at 152nd Meeting Amer. Chem. Soc., New York, Sept. 12-13, 1966) (Advances in Chemistry Series No. 69)

Crude shale oil was hydrogasified at 1000 lbs pressure over depleted uranium and cobalt molybdate catalysts at temperatures in the range 880° - 1102°F with depleted uranium and 974° - 1196°F with cobalt molybdate. With both catalysts, the higher reaction temperatures produced greater hydrocarbon gas yields, greater percentages of methane in the gas, and greater methane yields expressed as percentage of conversion of feedstock. The largest methane yields-- 4340 ft^3/barrel and largest hydrocarbon gas yield-- 5725 ft^3/barrel- were obtained at the highest temperature (1196°F) and lowest space velocity (0. 25 Vo/Vc/hr)used. At these conditions, methane yield was 75. 8 vol. % of the hydrocarbon gas and 49. 7% of stoichiometric gas. (Authors' Abs.)

866
Cralley, L. J., R. G. Keenan, J. R. Lynch, and others.
SOURCE AND IDENTIFICATION OF RESPIRABLE FIBERS. .
Amer. Indus. Hyg. Assoc. Jour., v. 29: 129-135, Mar.-Apr. 1968.

Fibrous bodies with an iron-containing coating have been found in the lungs of persons coming to autopsy in a number of urban hospitals, the number of fibrous bodies varying greatly with approximately 4-6% of the persons examined showing numerous bodies. Because these findings raise questions with regard to the possibility that asbestos is a factor in increased lung cancer, concerning the nature, source, and significance of these bodies are discussed in the light of research needed to find answers. (Authors' Abs.)

867
Crider, W. L.
AN AUTOMATIC FLAME EMISSION INSTRUMENT FOR SELECTIVELY MONITORING SO_2 IN ANIMAL EXPOSURE CHAMBERS.
In: Analysis Instrumentation, v. 4, Pittsburgh, Pa., Instrument Society of America, 1967, p. 67-73. (Proc. 12th Annual Analysis Instrumentation Symposium, Houston, Tex., May 11-13, 1966).

An automatic instrument employing the principle of flame emission photometry has been constructed to selectivity monitor SO_2 in animal exposure chambers. The instrument was calibrated over the range from 0.1 to 1.5 ppm (v/v) SO_2. Construction details and operating characteristics are presented. (Author's Abs.)

868
Denton, R., W. Forsman, S. H. Hwang and others.
VISCOELASTICITY OF MUCUS. ITS ROLE IN CILIARY TRANSPORT OF PULMONARY SECRETIONS. Amer. Rev. Respiratory Diseases, v. 98: 380-391, Sept. 1968.

The significance of the rheologic properties of biologic secretions to the interpretation of physiologic flow phenomena has been outlined, using the mucociliary transport system of the lung airways as an example. An instrument capable of measuring the viscoelastic properties of such secretions has been described and the interpretation of the results has been analyzed in terms of simple rheologic models. The significance of the results in terms of understanding the basic structure of mucus as well as possible clinical interpretations has been emphasized. Finally, investigation into the dynamics of ciliary-induced fluid flow has been described. (Authors' Abs.)

869
A DIGEST OF STATE AIR POLLUTION LAWS. Washington, D. C., Public Health Service, 1967, 556p. (PHS Publ. No. 711).

Arranged alphabetically by states and by territorial possessions of the United States, this volume provides for the most comprehensive survey of all state laws related to air pollution control. In addition, Public Law 90-148 (90th Congress. S. 780, November 21, 1967) is also included in form of an appendix.

870
Dimitriades, B.
METHODS FOR DETERMINING NITROGEN OXIDES IN AUTOMOTIVE EXHAUSTS. Washington, D. C., Dept. of the Interior, Bureau of Mines, May 1968, 29p. (R.I. 7133).

Five direct and indirect methods for determining nitrogen oxides in automotive exhausts have been evaluated from the standpoint of accuracy and applicability in current exhaust studies. These methods are: static oxidation in tank, Bureau of Mines method, Chevron Research method, phenoldisulfonic acid method, and direct measurement of NO. Results showed that methods requiring conversion of nitric oxide to nitrogen dioxide as a part of the analytical procedure are subject to errors introduced by the instability of NO_2. The extent of some of these errors has been determined, and procedures have been developed to minimize undesirable influences. On the basis of the results obtained from this study, recommendations are made regarding procedures for batch type or continuous measurement of nitrogen oxides in exhaust streams. (APCA Abs.)

871
Dorsey, J. A., and D. A. Kemnitz.
SOURCE SAMPLING TECHNIQUE FOR PARTICULATE AND GASEOUS FLUORIDES. Jour. Air Poll. Control Assoc., v. 18: 12-14, Jan. 1968.

Laboratory tests have demonstrated that the technique of converting reactive gaseous fluorides to a less reactive species before filtration of particulates can provide the basis for a stack sampling procedure. Field studies indicate the usefulness of the technique over a wide range of particulate and gaseous concentrations. Althrough these studies were not exhaustive and do not define the applicability of the method to all industrial sources of fluoride emissions, results are conclusive enough to warrant further evaluation in the field. (Chem. Abs.)

872
Douglass, I. B., F. J. Ward, and R. V. Norton.
SULFINATE ESTERS. II. THE SYNTHETIC UTILITY OF METHYL METHANESULFINATE. Jour. Org. Chem., v. 32: 324-325, 1967.

Methyl methanesulfinate can be converted into the butyl ester by refluxing with 1-butanol in the presence of catalytic amounts of sodium methoxide or sulfuric acid. Attempts to form the methoxysulfinyl carbanion and cause it to enter into Claisen-type condensations were unsuccessful. Similarly, no deuterium exchange could be demonstrated when the ester was heated with sodium methoxide in the presence of deuteriomethanol. After saponification of the ester, the resulting solution of sodium methanesulfinate readily reacted with compounds, such as benzyl chloride, butyl bromide, chloroacetone, phenacyl bromide, 2, 4-dinitrophenyl chloride, and methanesulfenyl chloride forming the expected methylsulfonyl compounds. Saponification of the ester, followed by acidification of the alkaline solution with formic acid and addition of formaldehyde and a nitrogen compound (amine or amide), yielded products formed by Mannich-type reactions. Methylsulfonyl methyl derivatives were prepared from urea, benzamide, acetamide, methanesulfonamide, and p-toluidine. Proton magnetic resonance δ shifts are reported for the compounds prepared. (Chem. Abs.)

873
First, M. W.
ENVIRONMENTAL HAZARDS: URBAN SOLID-WASTE MANAGEMENT. New England Jour. Med., v. 275: 1478-1485, 1966.

An urgent need for better methods of solid-waste management in all sectors of the economy, combined with the powerful stimulus provided by Solid Waste Act funds, is opening up a period of active development and experimentation in solid-waste technology that will result in the rapid introduction of the modern systems now needed. Solid-waste problems should be approached as an interdisciplinary study involving the special skills of urban planners, sociologists and economists, with those of sanitary engineers, public-health administrators and publicworks specialists. (Biol. Abs.)

874
First, M. W., F. J. Viles, Jr., and S. Levin.
CONTROL OF TOXIC AND EXPLOSIVE HAZARDS IN BUILDINGS ERECTED ON LANDFILLS. Public Health Repts., v. 81: 419-428, 1966.

The principal hazard associated with construction on refuse-filled land arises from anaerobic production of combustible gases by methane-producing bacteria. Gas-tight construction over landfills appears to be difficult, if not impossible, because of gas pressures under the structure resulting from biological gas production. During investigations of gas levels in a housing development constructed on sanitary landfills, unsafe methane concentrations were found in a high proportion of the buildings. A concrete slab laid on top of the fill did not prevent gases produced in the fill from penetrating into the buildings. Several sealants were tested and found inadequate. The results of periodic gas samplings conducted over several years in the subbasement spaces of a number of buildings indicated that organic fill located around and under heated buildings becomes completely degraded in approximately 5 years, releasing methane at a proportionately rapid rate. This produces a severe explosion hazard unless suitable methods of aerating and venting are employed. Continuous mechanical ventilation at a rate of 1 or 2 air changes per hour adequately reduced methane concentrations. (Authors' Abs.)

875
Flinn, J. E. and G. F. Sachsel.
EXPLORATORY STUDIES OF A PROCESS FOR CONVERTING OIL SHALE AND COAL TO STABLE HYDROCARBONS. Indus. and Eng. Chem., Process Design and Develop., v. 7: 143-149, 1968.

Oil shale and coal are retorted in a flowing H stream at pressures of 150-450 psia. The resulting H-hydrocarbon vapor stream is passed directly through a Co-Mo catalyst bed for removal of S, O, and N impurities and for olefinic bond saturation. The condensed vapors are found to yield a clear, stable, low-viscosity, liquid hydrocarbon. Volumetric yields of liquid product in excess of the Fischer assay value appear possible from the process. This concept of retorting differs from past approaches in that the direct production of a gasoline from coal or oil shale is the goal. (Chem. Abs.)

876
Forney, A. J., R. F. Kenny, S. J. Gasior, and others.
FLUID BED GASIFICATION OF PRETREATED PITTSBURGH SEAM COALS. In: Fuel Gasification. Ed. by R. F. Gould. Washington, D. C., Amer. Chem. Soc., 1967, p. 136-140. (Symposium sponsored by the Div. of Fuel Chem. at 152nd Meeting Amer. Chem. Soc., New York, Sept. 12-13, 1966) (Advances in Chemistry Series No. 69).

The Bureau of Mines is investigating a two-stage gasification process for caking coals involving a pretreater to remove the caking properties in series with a gasifier to convert the coal to gaseous products. The pretreater is operated at 250°C to make a treated coal with increased oxygen in the coal structure and at 450°C to make a treated coal with decreased volatile matter. In either case the products for the pretreater pass directly to the gasifier operated at 870°C. The yield of hydrogen, methane, and carbon monoxide is about 23 standard ft^3/lb of coal at 80% carbon conversion. The two-stage process with raw coal feed will yield more gas than gasification of a pretreated coal. (Author's Abs.)

877
Goetz, A. F. H., and C. A. Bauman.
APPARATUS TOME ASSURE MID-INFRARED SPECTRA EMITTANCE OF COLD POWDERS IN A VACUUM. Rev. Scient. Instr., v. 33: 775-778, 1967.

A compact apparatus enclosed in a stainless steel vacuum chamber was used to measure the 8-13 μ emittance of silicate powders under simulated lunar conditions for purposes of compositional analysis. Samples with surface temperatures as low as 180°K could be measured. The sample was contained in the removable lid of a constant temperature bath and its upper surface allowed to radiate into a cavity maintained at 77°K. The spectral emittance was computed by matching the observed spectrum with a Planck function at high emittance wavelength intervals. System response was determined with an internal calibrating blackbody maintained at 273°K. (Chem. Abs.)

878
Guilbault, G. G. and D. N. Kramer.
AN ELECTROCHEMICAL METHOD FOR THE DETERMINATION OF GLUCOSIDASE AND MERCURIC ION. Anal. Biochem., v. 18: 313-319, 1967.

An electrochemical method is described for the determination of the enzyme glucosidase and of Hg (II) which inhibits this enzyme. The method is based on the liberation of cyanide from the substrate amygdalin; the dyanide produced is measured using a Ag-Pt electrode combination in a spontaneous (internal) electrolysis cell. The changes in potential with time, Δ E/min, were found to be proportional to the activity of glucosidase over the range 0.00156-0.0780 unit/ml, and to the concentration of Hg (II) from 1×10^{-5} to 5×10^{-7} M. (Authors' Abs.)

879
Guilbault, G. G., D. N. Kramer, and E. Hackley.
FLUOROMETRIC DETERMINATION OF HYALURONIDASE AND OF Cu(II), Fe(II), AND CYANIDE ION INHIBITORS. Anal. Biochem., v. 18: 241-247, 1967.

A fluorometric method is described for the assay of the enzyme hyaluronidase and of Cu(II), Fe(II), and cyanide ions which inhibit the enzymic activity. The method for hyaluronidase is based upon the hydrolysis of the nonfluorescent indoxyl acetate by the enzyme to give the highly fluorescent indigo white (λ_{ex} = 395 mμ, λ_{em} = 470 mμ). Metal ions, such as Fe^{++} and Cu^{++}, and CN^-, which inhibit the enzyme, can be determined by recording their effect on the enzymic activity. By this procedure, from 0.0010 to 0.0330 μg/ml of hyaluronidase, 0.10 to 4.0 μg/ml of CN^-, 0.20 to 12 μg/ml of Fe^{++}, and 0.20 to 6 μg/ml of Cu^{++} could be determined with standard deviations of 1.8% for hyaluronidase and 2.3% for the inhibitors. Evidence is offered to demonstrate hyaluronidase, and not esterase, activity. (Authors' Abs.)

880
Halitsky, J.
TEMPERATURES AND CONCENTRATIONS IN HEATED PLUMES. Atmos. Environ., v. 2: 419-422, July 1968.

Volume concentrations and excess temperatures in plumes are shown to have the same distributions when normalized with respect to the values at the emission orifice. An expression is derived for calculating the dilution D, defined as the common ratio (source value)/(plume value) for volume concentration or excess temperature. It is shown that volume and mass concentration distributions are not similar in general, but that the discrepancy is small beyond the jet region. Use of the ambient temperature instead of the true plume temperature to convert from mass to volume concentration will introduce an error of less than 5% beyond the jet region. (Author's Abs.)

881
Hangebrauck, R. P., and P. W. Spaite.
CONTROLLING THE OXIDES OF SULFUR. Jour. Air Poll. Control Assoc., v. 18: 5-8: Jan. 1968.

Studies of the sources of SO_2 pollution show that combustion of fossil fuels is responsible for 78% of the total emissions to the atmosphere. The remaining 22% comes from other industrial operations in terms of severe local nuisances and ground-level concentrations. The great diversity in types and sizes of all resources requires an entire spectrum of approaches for control. The possible approaches to control can be categorized to include the desulfurization of residual fuel oil, process modification, and desulfurization of flue gas. Work on specific possibilities in each of these categories is underway both in the federal government and in industry. The needed solutions still lie in the future, and require every possible research and development effort. (Chem. Abs.)

882
Harman, D., and L. H. Piette.
FREE RADICAL THEORY OF AGING: FREE RADICAL REACTIONS IN SERUM. Jour. Gerontol., v. 21: 560-565, 1966.

Aging may be due in part to more-or-less random endogenous free radical reactions occurring both in the cells and the interstistial tissues. In this study free radicals have been detected in vitro in human serum at room temperature with the aid of electron spin resonance (ESR) spectroscopy; the serum signal, observed only at $g = 2.004$, is enhanced slightly by O_2. The data indicate that the ESR signal is most likely the resultant of the reaction of molecular O_2 with proteins, lipids, and smaller molecules such as ascorbic acid and epinephrine. It is suggested that free radical reactions arising in the plasma and adjacent tissue spaces may contribute to the development of the age-associated arteriolocapillary fibrosis and thus indirectly to the aging of the organism as a whole. (Authors' Abs.)

883
Harrington, R. E., R. H. Borgwardt, and A. E. Potter.
REACTIVITY OF SELECTED LIMESTONES AND DOLOMITES WITH SULFUR DIOXIDE. Amer. Ind. Hyg. Assoc. Jour., v. 29: 152-158, 1968.

Tests in a fixed-bed sorption unit were made to evaluate the reactivity of 10 naturally occurring limestones and dolomites with SO_2 in flue gas. Reactivity of individual samples varied with calcination temperature, and reaction temperature, the variations in reactivity among the different test materials, however, were greater and more significant. No correlation was found between differences in reactivity and chemical composition. Physical properties of the reactant materials appear to be important in sorbent reactivity. Although much additional research remains to be done, work thus far indicates that utilizing limestone or dolomite for removal of SO_2 from flue gas shows promise of being technically and economically feasible. (Authors' Abs.)

884
Hendrickson, E. R. and J. S. Lagarias.
CONTROL OF AIR POLLUTION FROM PHOSPHATE PROCESSING. Proc. Internat. Clean Air Congr., London (England), Oct. 1966, p. 97-99.

Phosphorus is one of the elements essential for the growth of human, plant, and animal life. One-third of the world's phosphate is processed in Florida where most of the products normally made from phosphorus rock are produced, and this results in a number of air pollution problems involving particulates, fluorides, and sulfur oxides. The manufacturing processes, sources of pollutants, and general effects of emission are described. Investigation, application, and procedures for alleviating the air pollution are discussed. (APCA Abs.)

885
Huey, N. A.
THE LEAD DIOXIDE ESTIMATION OF SULFUR DIOXIDE POLLUTION. Jour. Air Poll. Control Assoc., v. 18: 610-611, Sept. 1968.

A new system of measuring sulfation is presented. Because of its simplicity, operation of large sulfation networks can be accomplished at extremely nominal costs. Because of increased sensitivity, present 1-month sampling time intervals may be shortened to approximately 1 day. Use of this system will permit more definitive investigations of the relationship of sulfation to sulfur dioxide concentration. (Author's Abs.)

886
Jaffe, C. D. and W. F. Johnson.
MEASURING THE IMPROVEMENTS IN THE CONTROL ASPECTS OF PROGRAMS AIDED BY FEDERAL GRANTS. Jour. Air Poll. Control Assoc., v. 17: 316-320, May 1967.

Ambient air standards, emission standards, and program activities are considered in a search for appropriate indices for measuring program progress and effectiveness. The authors suggest that such indices can best be based on data related to weight of emissions. Several methods for expression accomplishment are presented for consideration. (Authors' Abs.)

887
Johnson, K. L., L. H. Dworetzky, and N. Hell.
CARBON MONOXIDE AND AIR POLLUTION FROM AUTOMOBILE EMMISSIONS IN NEW YORK CITY. Science, v. 160: 67-68, 1968.

Local business-day traffic determines the diurnal CO concentrations at individual sites in Manhattan. Concentrations during the day can be predicted from readings taken in early morning. (Authors' Abs.)

888
Kothny, E. L. and P. K. Mueller.
SUB-MINUTE CONTINUOUS NITROGEN DIOXIDE ANALYSIS. In: Proc. Internat. Clean Air Cong., London, (England), Oct. 1966, v. I, n. d., p. 182-184.

The effect of chemical and physical variables on the response of a nitrite reagent is described. For performance comparison an empirical parameter was developed. With the guidelines resulting from the application of these numbers a fast response reagent was developed containing N, N(1-naphthyl, acetyl) ethylene diamine, 2-amino-p-benzenedisulfonic and sulfuric acid. Designs of gas liquid contact and optical systems were evaluated to match fast response reagents. (APCA Abs.)

889
Lockhart, L. B., Jr., R. L. Patterson, Jr., A. W. Saunders, Jr., and others.
ATMOSPHERIC RADIOACTIVITY ALONG THE 80TH MERIDIAN (WEST). U. S. Atomic Energy Comm., Symposium Ser., v. 5: 477-296, 1965. (Conf. on Radioactive Fallout from Nuclear Weapons Tests, 2d., Germantown, Md., 1964).

Operation of the Naval Research Laboratory 80th Meridian Air Sampling Program, from May 1956 through December 1962 (eastern United States), took place during an interesting period in the nuclear age and the development of nuclear weaponry and covered the nearly 3-yr moratorium on nuclear testing as well as the episodes of intensive testing of high-yield devices both before and after the moratorium. Data collected during this program helped substantiate a number of concepts regarding atmospheric mixing processes and residence times of radioactive particulate matter in the atmosphere. Measurements are summarized of the concentrations of both gross β-activity and Sr^{90} activity in the air at ground level along the 80th meridian (west) during the period 1957 to 1962. More-detailed results and interpretations are given for collections of radioactivity made in 1962. (Chem. Abs.)

890
Lovill, J. E. and A. Miller.
THE VERTICAL DISTRIBUTION OF OZONE OVER THE SAN FRANCISCO BAY AREA. Jour. Geophys. Res., v. 73: 5073-5079, Aug. 1968.

Observations of the vertical distribution of ozone were made during February 1967 in the San Francisco Bay area with the Carbon-iodine (Komhyr) ozonesonde. Horizontal and vertical velocity components were obtained by simultaneous tracking with an M33 radar. In the lower troposphere, two peaks of O_3 were found near 1 and 1.5 km within the West Coast subsidence inversion; the lower maximum coincides in position with a wind jet. In the middle and upper troposphere there are significant time variations of O_3, believed to be caused by intrusions of stratospheric air. Undulations in the O_3, temperature, and wind profiles in the stratosphere suggest laminas of air masses. The mean profile of O_3 suggests that there are several distinct zones that are related to O_3 production and vertical mixing (Authors' Abs.)

891
Low, M. J. D. and L. Abrams.
MEASUREMENTS OF THE INFRARED SPECTRAL TRANSMITTANCE OF OPTICALLY THICK SAMPLES. Rutgers State Univ., School of Chemistry, New Brunswick, N. J. ONR Technical Report No. 2, June 20, 1966, 23p. (Nonr 404(19)) AD 630035

Continued improvements in instrumentation have led to a wide use of ir transmission spectroscopy, and have permitted the examination of samples of limited transparency. However, although there is no particular problem with samples having about 2% transmittance or more, considerable difficulties arise if the transmittance is in the fractional percent range. The present paper is concerned with such energy-limited spectral measurements. The effects of self-emitted radiation, ordinate expansion, and scan time are considered. (Chem. Abs.)

892
McMichael, W. F., E. Kruse, and M. Hill.
PERFORMANCE OF EXHAUST CONTROL DEVICES ON 1966 MODEL PASSENGER CARS. Jour. Air Poll. Control Assoc., v. 18: 246-248, 1968.

Road tests were carried out in 5 different cities with a fleet of 300 passenger cars consisting of 3 different makes, 1/2 of which are equipped with the 1966 exhaust control devices required by the state of California. The performance of these devices during the 1st series of tests was evaluated. All 3 makes of device-equipped cars produced significantly lower emissions of hydrocarbons and CO than did similar cars tested in 1962 and 1963. There were no consistent differences among the 3 makes of cars with respect to CO and hydrocarbon emissions. (Authors' Abs.)

893
Maga, J. A.
INSTRUMENTATION REQUIREMENTS FOR AUTOMOTIVE EMISSIONS. In: Symposium Air Pollution Instrumentation, Los Angeles, Calif., Oct. 1965. Pittsburgh, Pa., Instrument Society of America, 1966, p. 13-15.

The main instrumentation needs for automotive emission studies are: (1) Analytical methods to measure the concentration of pollutants discharged, (2) Improved sampling methods, (3) Accurate laboratory reproduced engine load road conditions, and (4) Tests and instrumentation to assure that the control devices on cars continue to work for ten to fifteen years. These problems are presented and commented upon.

894
Morrison, M. E.
DIFFUSION COEFFICIENTS FOR ORGANIC VAPORS IN POLY-(VINYL ACETATE). A.I.Ch.E. Jour., v. 13: 815-816, 1967.

An equation for the evaluation of diffusion coefficients in terms of an activity gradient for benzene, acetone, and $PrNH_2$ in poly(vinyl acetate) (I) was derived. These diffusion coefficients did not vary as significantly with concentration as did the Fick diffusion coefficient for the benzene-I system. For the diffusion of acetone or $PrNH_2$, both diffusion coefficients appeared to be quite concentration dependent. (Chem. Abs.)

895
Mountain, I. M., E. J. Cassell, D. W. Wolter, and others.
HEALTH AND THE URBAN ENVIRONMENT. VII. AIR POLLUTION AND DISEASE SYMPTOMS IN A "NORMAL" POPULATION. Arch. Environ. Health, v. 17: 343-352, Sept. 1968.

The effect of each of several pollutants on the health of urban families on the lower East Side of New York City has been assessed. Prevalence of certain symptoms on one day of the week (Monday) was assessed according to level of each pollutant (low, medium, or high). Prevalence was treated as a binomial variable (number of "yes" responses/number of "yes" and "no" responses) whereas pollutant level was a continuous variable (but ordered, by thirds), according to the method of Armitage. In summer, in children under 8 yr of age, prevalence of respiratory symptoms was directly related to increasing levels of particulate matter and of carbon monoxide. In heavy smokers, prevalence of eye irritation and headache was directly related to increasing levels of carbon monoxide. (Authors' Abs.)

896
Mudd, J. B.
BIOCHEMICAL EFFECTS OF AIR POLLUTANT OXIDANTS. California Univ., Riverside. Progress Report, Sept. 1, 1965 - Aug. 11, 1967. [26]p.

In order to better define the toxicity of ozone, its reaction with amino acids and proteins were studied under conditions closely approximating physiological conditions, that is, in aqueous buffered solutions. Ozone was generated by passing oxygen through an apparatus producing a silent electric discharge. Solutions of amino acids and proteins were exposed to ozone by permitting the gas to bubble through the solutions from a capillary tip. The following order of susceptibility of amino acids to oxidation by ozone was found: cysteine, methionine, tryptophan, tyrosine, and histidine were dependent on pH, being greater under alkaline conditions. The oxidation of pancreatic ribonuclease by ozone resulted in a decrease in enzymic activity. The amino acid residues most affected by treatment with ozone were tyrosine and histidine. Reaction of avidin with ozone caused changes in the absorbance spectrum characteristic of the tryptophan residues. The biotin binding capacity of avidin was lost after treatment of avidin with ozone. The studies reported herein cannot be used to predict the effect of ozone on lipoprotein membranes, and it remains for direct experiment to ascertain whether the lipid or the protein of biological membranes is first damaged by ozone. (APTIC Abs.)

897
O'Keeffe, A. E., and G. C. Ortman.
PRECISION PICOGRAM DISPENSER FOR VOLATILE SUBSTANCES. Anal. Chem., v. 39: 1047, July 1967. (Presented in part at: 152nd Meeting Amer. Chem. Soc., Div. of Water, Air, and Waste Chem., New York City, Sept. 14, 1966).

The construction and filling of a low range permeation device is illustrated. A glass envelope is drawn down to a size that forbids passage of a spherical glass bead. A gas-tight fit is obtained between the glass envelope and an FEP Teflon insert which circumscribes the bead by extruding the plastic member through the neck of the glass envelope. The lowest emission rate 4×10^{-12} g/sec (propene, room temperature). For liquefiable gases incompatible with FEP Teflon, TFE Teflon is used. For dispensing fixed gases, including those which cannot be handled safely at operating temperatures, a flat permeation membrane supported by a porous metal disk is connected directly to a cylinder of gas. Thickness and area of the membrane are selected to yield any desired flow rate. (APTIC Abs.)

898
Ott, W., J. F. Clarke, and G. Ozolins.
CALCULATING FUTURE CARBON MONOXIDE EMISSIONS AND CONCENTRATIONS FROM URBAN TRAFFIC DATA. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, 40p. (PHS Publ. No. 999-AP-41)

An urban area approach was applied in Washington, D. C., to calculate present and future emissions and ambient concentrations of CO. Calculations were based on 1964 and projected 1985 traffic volumes, emission factors, and a meteorological diffusion model. The following findings were obtained: (1) The total CO emissions in Washington will almost double in a non-uniform manner with no emission control, (2) Because of the nonuniformity the area of the city exposed to high emission densities will increase as a consequence the area over which concentrations occur will also increase, (3) Concentration changes at any one site are more influenced by the emission pattern of the entire urban area than by changes in the immediate vicinity, (4) Without control, the mean annual concentrations at four varied sites in Washington would show a 44 to 69% increase over 1964 values, (5) With 50% control the 1985 concentration at the CAMP station will be 15% less than the 1964 value and values at the other sites will drop from 21% to 29%, (6) Concentrations for the weekday peak traffic period calculated for 1984 will increase 40% to 120% over the 1964 values, and (7) Even with 50% control, some peak-traffic-period concentrations will increase 10%. (Author's Abs., Modified)

899
Peterson, C. M., and H. J. Paulus.
CONTINUOUS MONITORING OF AEROSOLS OVER THE 0.001- TO 10-MICRON SPECTRUM. Amer. Indus. Hyg. Assoc. Jour., v. 29: 111-122, 1968.

Three aerosol sizing and counting instruments were combined into a single automatic system capable of continuously providing data pertinent to the physical properties of airborne particulates. Particle sizes are determined by either condensation, light scattering, or electrical phenomena. All three methods are required to measure broad-size aerosol spectrums, as each individual method possesses accurate sizing characteristics over a limited size range. The instruments, combined into a unitized system, provide data on particles within various internal widths and group the respective sized particles according to the interval mid-point. An appropriate electrical signal, indicative of the number of particles present, is recorded by electronic instrumentation, and subsequent calculations result in a complete number-size distribution. The union of the condensation nuclei counter, the lightscattering counter, and the electrical particle counter with associated data acquisition equipment to produce a workable system is described. Data reduction, as applied to the determination of a number-size distribution is also discussed. (Authors' Abs.)

900
Pilat, M. J., and R. J. Charlson.
THEORETICAL AND OPTICAL STUDIES OF HUMIDITY EFFECTS ON THE SIZE DISTRIBUTION OF A HYGROSCOPIC AEROSOL. Journal de Recherches Atmosphèriques (Clermont-Ferrand), v. 4: 165-170, 1966.

The effect of humidity upon the light scattering coefficient, and correspondingly the size, of a NaCl aerosol was calculated and observed. The aerosol radius was calculated as a function of relative humidity using a physical adsorption equation for the solid NaCl particles and a combination of Raoult's law and the Kelvin equation for the liquid solution droplets. The Rayleigh equation was used to calculate the ratio of the scattering coefficient at some humidity to the scattering coefficient at zero humidity. The predicted increase in the ratio of scattering coefficients transition of a solid salt particle to a saturated solution droplet, which agrees favorably with the ratio optically measured with an integrating nephelometer. (Authors' Abs.)

901
Reist, P. C., and W. A. Burgess.
A COMPARATIVE EVALUATION OF THREE AEROSOL SENSING METHODS. Amer. Indus. Hyg. Assoc. Jour., v. 29: 123-128, 1968.

Several direct reading methods for aerosol counting and sizing were suggested in the literature in recent years. An investigation of three proposed techniques — a piezoelectric crystal sensor, an acoustical sensor, and a hot-wire sensing element are reported — and their relative merits with each other compared. The hot-wire anemometer appears to offer the most promise for further development, particularly because of its ability to discriminate between solid and liquid aerosols. (Authors' Abs.)

902
Sachdev, S. L., and P. W. West.
MICRODETERMINATION OF ORTHOPHOSPHATE USING THE RING OVEN TECHNIQUE. Atmos. Environ., v. 2: 331-337, July 1968.

A rapid and highly selective method for the microdetermination of orthophosphate using orthodianisidine molybdate reagent and the ring oven technique is presented. As little as 0.1 μg of orthophosphate can be determined with reasonable accuracy. Very little interference is involved. Only Zr^{4+}, Al^{3+}, and Th^{4+} have been found to intefere when present in 100-fold excess. The method is of special interest for air pollution studies. (Authors' Abs.)

903
Schleusener, S. A., and A. A. Read.
SMALL PARTICLE SIZING USING TURBIDIMETRIC LAYERED SEDIMENTATION. Rev. Scient. Instr., v. 38: 1152-1156, 1967.

Application of turbidimetry to layered sedimentation for use in small particle sizing was investigated both theoretically and experimentally. The cavity of a 6328 Å He-Ne gas laser is used to detect the low light losses experienced during layered sedimentation tests. (Chem. Abs.)

904
Shulman, H. L., and W. G. Mellish.
PERFORMANCE OF PACKED COLUMNS. VIII. LIQUID FLOW PATTERNS AND VELOCITIES IN PACKED BEDS. A. I. Ch. E. Jour., v. 13: 1137-1140, 1967.

To develop a basis for a better understanding of the behavior of the liquid phase in packed columns, liquid velocities and flow patterns were studied at several typical points in a column packed with 1.0-in. procelain Raschig rings with a high-speed photographic technique. Liquid velocities fluctuated rapidly with time. Laminar flow predominates, but mixing occurs at junctions between pieces of packing. A complex model is required to describe the behavior of the liquid phase in packed columns. (Chem. Abs.)

905
Singer, I. A., N. E. Busch, and J. A. Frizzola
THE MICROMETEOROLOGY OF THE TURBULENT FLOW FIELD IN THE ATMOSPHERIC SURFACE BOUNDARY LAYER. Brookhaven National Lab., Upton, N. Y., 1967, 50p. (CONF-670943-1).

The background is outlined for the Monin-Obukhov similarity hypothesis which describes the height dependence of various turbulent flow parameters in a thermally stratified surface boundary layer (for instance the mean wind profile, mean temperature profile, turbulence intensities, etc.) The implications of the hypothesis are discussed. A recent analysis of spectral data taken at Brookhaven National Laboratory under thermally neutral and unstable conditions is presented and compared with other analyses. The insight already gained has not been fully applied to practical problems such as structural design, atmospheric pollution, agriculture, etc. The present paper is educational in nature, aimed at conveying some of the elements of current thinking in the field of micrometeorology. Its prime purpose is to outline the basic ideas behind the Monin-Obukhov hypothesis and to discuss the spectra of turbulent wind fluctuations within this framework. (APTIC Abs.)

906

Soo, S. L.
DIRECT ENERGY CONVERSION. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1968. 344p.

This book is intended to cover completely basic concepts of direct energy conversion. As much concern is devoted to the similarities as to the differences in details of various devices. Generalization includes representation and analysis in terms of transport of charge carriers and energy level diagrams, as well as classification based on irreversible thermodynamics. Specific devices and their fundamentals are treated as engineering cases. Criteria for comparison, selection, and design are given from considerations of physical limitations, missions, and systems. Contents include fundamental concepts, electrochemical effects and fuel cells, thermionic systems, thermoelectric systems, radiation cells, electrostatic and magnetic systems, magnetohydrodynamic generators and other fluid energy converters, fluid plasma generators, and general considerations of direct energy conversion. (APCA Abs.)

907

Stair, R.
THE MEASUREMENT OF SOLAR RADIATION, WITH PRINCIPAL EMPHASIS ON THE ULTRAVIOLET COMPONENT. Air and Water Poll., v. 10: 665-688, 1966.

A review is presented covering much of the scientific work of the past half-century relating to the measurement of the spectral distribution of radian energy (in particular in the uv [ultraviolet] region) from the sun. Mention is made of those special solar disturbances that are expected to result in large variations of the uv solar emission as well as the absorbing medium, ozone, which through its turbulence and distribution further effects greatly the spectral distribution of the solar radiation reaching the earth's surface at any locality. Various instrumentations and the standards employed by the different laboratories are discussed in some detail with emphasis placed upon some of their shortcomings and the great lack of accurate solar spectral data, in particular within the uv region. Finally, new instrumentation offering promise of considerable usefulness in obtaining rapidly more accurate data in this area is described. (Author's Abs.)

908

Stotzky, G.
INFLUENCE OF CLAY MINERALS ON MICROORGANISMS. III. EFFECT OF PARTICLE SIZE, CATION EXCHANGE CAPACITY, AND SURFACE AREA ON BACTERIA. Canadian Journal of Microbiology (Ottawa), v. 12: 1235-1246, 1966.

The stimulation of bacterial respiration by clay minerals was related to certain physiochemical, characteristics of clays. Respiration increased with an increase in the cation-exchange capacity and surface area of the particles. The importance of surface area, however, could not be unequivocally established, as some of the methods used to determine this characteristic on certain clay species were questionable. Particle size did not appear to be a critical characteristic. The implications of the cation-exchange capacity of clay minerals in the activity, ecology, and population dynamics of microorganisms in nature are discussed. (Chem. Abs.)

909
Turner, D. B.
THE DIURNAL AND DAY-TO-DAY VARIATIONS OF FUEL USAGE FOR SPACE HEATING IN ST. LOUIS, MISSOURI. Atmos. Environ., v. 2: 339-351, July, 1968.

Data on the wintertime emissions of SO_2 from residential and commercial space-heating sources by 2-hr periods were needed for use in a diagnostic dispersion model. Analyses were made of hourly steam output data from a centralized heating plant and hourly gassendout data for December 1964 at St. Louis, Missouri to determine dependence upon temperature and other factors. Methods were then developed to determine the rate of fuel use from residential and commercial space-heating sources for each hour of the day from values for the hourly temperature, the hour of the day, and the day of the week. Relations developed from December 1964 data were tested on data for January and February 1965. (Author's Abs.)

910
Urone, P., H. Lutsep, C. M. Noyes, and others.
STATIC STUDIES OF SULFUR DIOXIDE REACTIONS IN AIR. Environ. Sci. & Technol., v. 2: 611-618, 1968.

Reactions of SO_2 in ppm concentrations and in the presence of saturated and unsaturated hydrocarbons, NO_2, moisture, particulates, and uv irradiation were studied by a combination of colorimetric and radio-tracer techniques. Gaseous mixtures kept in the dark for days did not react, whereas SO_2 in the presence of powdered oxides of Al, Ca, Cr, Fe, Pb, and V reacted within minutes without sunlight or uv irradiation. Reactions in the presence of powdered NaCl and $CaCO_2$ were very slow compared to reactions in the presence of the metal oxides studied. The photochemical reaction rate of SO_2 in air in the presence of water vapor up to 100% relative humidity was of the order of 0.1%/hr in uv irradiation equivalent to noonday sunlight intensities. When hydrocarbon and NO_2 were present, the photochemical reaction in the gas phase was noticeably faster and of the order of a few %/hr. Under these conditions, a photochemical product not involving SO_2 was formed, adhered to the walls of the flask, and slowly reacted with SO_2 after it had been collected with the West-Gaeke sampling solution (Chem. Abs.)

911
Vaughan, M. C., R. P. Smith, and R. E. Dosselin.
EFFECTS OF OXYGEN ON DETERMINATION OF THIOCHOLINE BY 5,5'-DITHIOBIS(2-NITROBENZOIC ACID). Proc. Soc. Exper. Biol. and Med., v. 122: 50-55, 1966.

The DTNB (5,5'-dithiobis-2-nitrobenzoic acid) method was recommended for measuring the hydrolysis of thiocholine esters. During studies on the alkaline hydrolysis of benzoylthiocholine, analytical errors were encountered and traced to the presence of molecular O_2. Although O_2 does not influence the rate of benzoylthiocholine hydrolysis, it does compete with DTNB for the hydrolysis product thiocholine. It produces fading of the chromogen on which the assay is based by oxidizing the monothiol TNB back to DTNB. Thus any amount of thiocholine released is significantly underestimated if hydrolysis periods of 30 min or more are employed. In the absence of O_2 DTNB can be added at any time during the hydrolysis, but in the procedure recommended here it is present throughout. This modified DTNB method was used to determine rate constants for autooxidation of thiocholine and for spontaneous alkaline hydrolysis of acetyl- and benzoylthiocholines. Unlike acetylthiocholine, benzyolthiocholine proved to be so unstable in various buffered solutions at pH% that it appears to have only limited usefulness as an enzyme substrate. (Authors' Abs.)

912
Woodcock, A. H., M. Rubin, and R. A. Duce.
DEEP LAYER OF SEDIMENTS IN ALPINE LAKE IN THE TROPICAL MID-PACIFIC. Science, v. 154: 647-648, Nov. 4, 1966.

A high-altitude lake on Hawaii appears to have been a natural trap for sedimentary materials since the lake was formed, probably in Pleistocene time. More than 7.5 m of sediments were recently found on the bottom of this lake by probing it with a steel rod. Analysis of these sediments indicate ash fall and other airborne and underwater materials for a period estimated to extend into the Pleistocene.

913
Wullstein, L. H., and C. M. Gilmour.
NON-ENZYMATIC FORMATION OF NITROGEN GAS. Nature, v. 210: 1150-1151, 1966.

Experiments presented in this communication indicate that nitrogen gas can be formed as a result of reacting potassium nitrate and ferrous sulfate. Non-enzymatic formation of nitrogen mediated by transition-like metals may help to clarify previously unexplainable losses of mineral nitrogen from both soil and cell preparations. (Biol. Abs.)

(a) Aerosols

914
Bamesberger, W. L., and D. F. Adams.
AN ATMOSPHERIC SURVEY FOR AEROSOL AND GASEOUS 2,4-D COMPOUNDS. In: Organic Pesticides in the Environment. Washington, D. C., Amer. Chem. Soc., 1966, p. 219-227. (Advances in Chemistry Series No. 60).

A differential sampling system collected 24-hr fractions of airborne aerosol and gaseous herbicides at 2 Washington field sites for approximately 100 days in 1964. The continuously sampled air impinged on an impaction disk rotating through a collection fluid to retain the droplets of impacted aerosols. Adhering solution was removed from the disk with a Teflon squeegee. The gaseous fraction was collected in a modified midget impinger containing a 2-phase n-decane and 3.0% aqueous $NaHCO_3$ solution. The n-decane phases were analyzed directly for 2,4-D esters by electron capture chromatography. The aqueous phases were acidified, extracted, methylated, and the parent 2,4-D compounds were determined by electron capture chromatography as their methyl esters. The system is suitable for differential collection of all types of airborne agrichemicals. (Chem. Abs.)

915
Brock, J. R.
DYNAMIC THEORIES OF KNUDSEN AEROSOLS. Jour. Air Poll. Control Assoc., v. 17: 589, Sept. 1967.

Mass momentum, and energy transfer to single aerosol particles in the Knudsen transition region have been described in an approximate but nonintuitive manner through solution of the BGK model of the Boltzmann equation using iterative procedures. Work completed includes description of the following phenomena in the transition region: evaporation and condensation of single aerosol particles, stationary and moving; unipolar diffusion charging of aerosol particles; thermophoresis; diffusiophoresis; heat transfer from a single aerosol particle; time dependent transfer processes to single aerosol particles. The inadequacies of other approximate but intuitive approaches to the description of transfer processes to single Knudsen aerosol particles have been pointed up; these approaches include the "delta" or dividing sphere method, mean free path analysis, and moment solutions of the Boltzmann equation. These and other results for the Knudsen transition region together with previous results for the slip flow region provide a fairly complete description of mass, momentum, and heat transfer to single aerosol particles over the entire Knudsen region. Work is completed or in progress on descriptions of aerosol coagulation, aerosol collection on cylinders and phase surfaces, and related topics for the Knudsen number transition region. (Air Poll. Abs.)

916
Brock, J. R.
SOME NEW METHODS OF AEROSOL PARTICLE MOTION: PHOTODIFFUSIOPHORESIS. Jour. Phys. Chem., v. 72: 747-749, 1968.

Some new modes of aerosol particle motion are defined. These modes, termed "photodiffusiophoresis," arise from molecular diffusion velocities produced by electromagnetic radiation incident on a particle. The electromagnetic radiation produces the diffusion velocities by altering the chemical or physical equilibrium between an aerosol particle and a surrounding gas mixture. Photodiffusiophoresis, therefore, is quite different from what has usually been termed "photophoresis," which occurs even in a pure gas and which in mixtures involves no diffusive motion of gas molecules. Photophoresis describes the particle motion due to unequal heating of the particle surface by incident electromagnetic radiation; this unequal heating causes gas molecules that rebound from the particle surface to impart more momentum from the hot portions of the surface than from the cold portions with a resultant force on the particle. In photophoresis, unlike photodiffusiophoresis, the molecular fluxes to and from the particle surface are equal. The term "photophoresis," as it has been applied in the past, should be changed more properly to "photothermophoresis," and both photothermophoresis and photodiffusiophoresis could be described by the term photophoresis. As an example, the photodiffusiophoresis arising from the photocatalytic oxidation of CO on ZnO is discussed. (Chem. Abs.)

917
Brock, J. R.
TIME-DEPENDENT TRANSFER PROCESSES TO AEROSOL PARTICLES IN NONCONTINUUM REGIONS. Jour. Colloid Interface Sci., v. 23: 286-291, 1967.

Noncontinuum and time-dependent transfer processes in the free-molecular and continuum regions are discussed. The theory of unsteady-state processes as applied to condensing and evaporating aerosols is also discussed as well as the correctness of certain quasi-stationary assumptions. (Chem. Abs.)

918
Burson, J. H., III, C. Orr, Jr., and R. Cheng.
THE INFLUENCE OF ELECTROSTATIC EFFECTS ON THE DISPERSION OF ORGANIC POWDERS. Georgia Inst. of Tech., Engineering Experiment Station, Atlanta. Semiannual Report No. 1, Mar. 1967, 35p. (Contract No. DA 18-035-AMC-1058(A))
AD 814000L

The electrostatic charging characteristics of powders are related to the dispersion and the stability of the aerosol so formed. The experimental apparatus consists essentially of a powder dispersing device, an aerosol chamber, and appropriate instrumentation for monitoring the electrostatic charges developed upon dispersion and the subsequent cloud decay rate. Results have been found to be very sensitive to the previous treatments given powders and to the apparatus-cleaning methods. Results of fairly good precision and reproducibility have been obtained using standardized operating techniques. Mixtures of two powders that charge with individually opposite polarities exhibit electrostatic characteristics upon dispersion that are approximately proportional to the relative amounts of each present. The stabilities of the resulting aerosol clouds were not predictable on the basis of charging behavior. Preliminary results indicate that enhanced cloud stability is obtained when Linde - A powder is dispersed with A or CO_2 as opposed to N. A residue of antistatic agent, Anstac M, on the surface of experimental apparatus has been found to be effective in reducing the magnitude of the electrostatic charge developed upon dispersion. (APTIC Abs.)

919
Calvert, S.
AEROSOL RESEARCH ACTIVITIES AT THE CENTER FOR AIR ENVIRONMENT STUDIES, THE PENNSYLVANIA STATE UNIVERSITY. Jour. Air Poll. Control Assoc., v. 17: 592-596, Sept. 1967.

Aerosol research at the Center relates to the broad interests in aerosol collection processes, definition of atmospheric particulates, and development of apparatus for particle generation and characterization which is necessary for research. (Air Poll. Abs.)

920
Charlson, R. J.
ATMOSPHERIC AEROSOL RESEARCH AT THE UNIVERSITY OF WASHINGTON. Jour. Air Poll. Control Assoc., v. 18: 652-654, Oct. 1968.

The research centering on the problem of the relationship of aerosol properties and the visibility in the atmosphere is discussed. The integrating nephelometer has been refined, adapted, and used extensively for the following applications: (1) studies on the relationship of mass, concentration, light scattering and visibility; (2) monitoring the light scattering coefficient as a function of time in a stationary location; (3) measurement of the dispersion rate of smoke from the burning of logging wastes (slash) and forest aerosols; (4) mobile reconnaissance and the problems of spatial variation in urban areas; (5) studies of the aerosol "background" air in entering the pacific northwest from uninhabited areas; and (6) investigations of the wavelength dependence of the light scattering coefficient of atmospheric aerosols.

921
Corn, M.
AEROSOL RESEARCH AT THE UNIVERSITY OF PITTSBURGH. Jour. Air Poll. Control Assoc., v. 17: 606-607, Sept. 1967.

Current aerosol research in this laboratory covers four general areas: (1) the shape and chemical characteristics of atmospheric particles, (2) optical properties of particles, (3) formation of aerosols, and (4) biological effects of inhaled irritant gases and gas-aerosol mixtures. (Air Poll. Abs.)

922
Gieseke, J. A.
AEROSOL RESEARCH AT BATTELLE-COLUMBUS. Jour. Air Poll. Control Assoc., v. 18: 682-684, Oct. 1968.

The behavior of aerosol clouds is often not consistent with the usual single-particle analysis of aerosol systems. The effect of aerosol concentration on sedimentation of aerosol clouds is discussed. Experiments on the settling of aerosol clouds and the effect of thermal forces on suspended aerosol particles are described.

923
Gucker, F. T., E. C. Osborne, and J. Trima.
PHYSICO-CHEMICAL STUDIES OF AEROSOLS. Jour. Air Poll. Control Assoc., v. 18: 664-665, Oct. 1968.

Light scattering from individual aerosol particles may serve to determine particulate concentration and size distribution. To determine the limits of applicability of these methods calculations of theoretical scattering curves for isotropic spheres of different refractive indices are needed. Scattering calculations are discussed as are applications. It is found that increasing the size of the collecting aperture increasingly distorts the ideal scattering diagram.

924
Hendricks, C. D.
UNIFORM PARTICLE SOURCES FOR POLLUTION RESEARCH. Jour. Air Poll. Control Assoc., v. 18: 669-670, Oct. 1968.

The great interest in air pollution research and in solutions to the problems of particulate matter in the atmosphere in general has made obvious the need for sources of well-controlled particles. The production and control of liquid drops is discussed. Techniques for forming both solid and liquid particles with very carefully controlled size and charge are described.

925
Hidalgo, A. F. and C. Orr, Jr.
HOMOGENEOUS NUCLEATION OF SODIUM CHLORIDE SOLUTIONS. Indus. and Eng. Chem., Fundamentals, v. 7: 79-83, 1968.

Experimental confirmation of the theory of homogeneous nucleation for electrolyte solutions is demonstrated by an analysis of the behavior at 25° of an aerosol composed of supersaturated NaCl solution droplets 0.01-0.1 μ in diameter. (The term homogeneous applies to systems devoid of foreign nuclei.). The humidity of the air with which the aerosol was in equilibrium was adjusted to attain a series of droplet supersaturation states. Nucleation and crystallation of the droplets subsequently ensued, the event being detected by an ion counter that permitted following the size of the aerosol particulates as a function of time at specific relative humidities. The behavior of the aerosol is attributed to homogeneous nucleation since only a small proportion of the droplets contained foreign nuclei when they were formed upon subdivision of the original liquid. The time for nucleation was found to be a logarithmic function of the electrolyte activity as theory predicts. (Chem. Abs.)

926
Kerker, M. and E. Matijevic.
PREPARATION OF SUBMICRON AEROSOLS OF NARROW SIZE DISTRIBUTION AND THEIR ANALYSIS BY LIGHT SCATTERING. Jour. Air Poll. Control Assoc., v. 18: 665-667, Oct. 1968.

The technique of preparing submicron aerosols and analyzing their particle size distribution by light scattering is briefly reviewed. A schematic diagram of the equipment used to prepare liquid aerosols is given.

927
Kitani, S., and S. Ouchi.
PREPARATION OF MONODISPERSE AEROSOLS OF SODIUM CHLORIDE. Jour. Colloid Interface Sci., v. 23: 200-202, 1967.

A modification of a generator for the preparation of NaCl aerosols of narrow size distribution is described. The experimental conditions for the aerosol preparation were determined by the flow rate of the carrier gas, the temperature of the boiler, and the temperature of the reheater. The aerosols, consisting of spherical particles, can be generated by 2-stage homogeneous nucleation. The size distribution was determined from the polarization ratio of the scattered light by assuming that the particle size distribution follows a log normal frequency curve. (Chem. Abs.)

928
Liu, B. Y. H.
METHODS OF GENERATING MONODISPERSE AEROSOLS (SECTION II). In: A Study of Atomizer Aerosol Generators. Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis. Progress Report No. AP-00480-2, Aug. 1967, p. 1-34. (Publ. No. 104) (Report No. C00-1248-10) (Presented at: 8th Conf. Methods in Air Pollution and Industrial Hygiene Studies, Oakland, Calif., Feb. 6-8, 1967).

The methods of generating monodisperse aerosols are discussed. The principal characteristics, advantages and limitations of the following methods are given: (1) spinning disk aerosol; (2) generator; (3) atomizer-impactor generator; and (4) condensation generator. (APTIC Abs.)

929
Liu, B. Y. H.
SUB-MICRON DROPLET SIZE DISTRIBUTION OF AEROSOL SPRAYS DISPERSED BY LIQUEFIED-GAS PROPELLANTS (SECTION IV). In: A Study of Atomizer Aerosol Generators, Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis Progress Report No. AP-00480-2, June 1967, p. 1-31.

Aerosol sprays dispersed by liquefied-gas propellants are used in a variety of consumer products. The effectiveness of the aerosol in accomplishing the purpose for which it is intended depends on the size distribution of the spray droplets. Laboratory development of an Electrical Particle Counter (EPC) has been undertaken for the in situ size measurement of sub-micron aerosols. The objectives of the study reported in this paper are to use the EPC to perform some preliminary measurements on the droplet size distribution of aerosol sprays and to gain some insight into the nature of the spraying process and the factors effecting the droplet size distribution of such sprays. Measurements were made on five aerosol samples, each of which contained a mixture of 2% DOP (Di-Octyl-phthalate) and a Freon propellant in a standard pressure container used for the ant and roach killer produced by the Johnson Co. and sold under the brand name "Raid". The voltage-current curves obtained by the EPC for the samples tested and data analysis are tabulated. Based upon the limited amount of data obtained thus far, it is concluded that there is a high probability that the size distribution of the aerosol sprays studied is determined by the degree of droplet coagulation that has taken place in the region immediately outside the orifice since the initial formation of the liquid droplets. (APTIC Abs.)

930
Liu, B. Y. H., and K. T. Whitby.
PARTICLE CHARGING AT LOW PRESSURES. U. S. Atomic Energy Comm., Symposium Series No. 5: 260-280, 1965.

The electric charge imparted to particles at reduced pressures was measured for particles ranging 0.02-2.0 μ and for pressures ranging 0.01-1.0 atmosphere with an improved particle-mobility analyzer of cylindrical geometry. The solid spherical particles of methylene blue dye are charged by positive ions in electric fields of various intensities. The measured particle charge is generally higher than the values predicted by White's equations, and the difference increases with decreasing pressure. Typically, the measured charge at 0.01 atmosphere is 100% higher than the values predicted by the diffusion-charging equation and is slightly less than one order of magnitude higher than what the field-charging equation predicts. (Chem. Abs.)

931
Liu, B. Y. H., K. T. Whitby, and H. H. S. Yu.
A CONDENSATION AEROSOL GENERATOR FOR PRODUCING MONODISPERSED AEROSOLS IN THE SIZE RANGE, 0.036 MICRON TO 1.3 MICRONS. Journal de Recherche Atmospheriques (Clermont-Ferrand), v. 2: 397-406, Apr.-Sept. 1966.

A condensation aerosol generator capable of producing monodispersed aerosols over the size range from 0.036 microns to 1.3 microns has been developed. The generator was calibrated over the entire range of drop size by four different methods including an optical particle counter, microscopic measurement of the collected liquid drops, an electrical particle counter and an electrical method in which a representative fraction of the liquid drops were charged with one elementary unit of charge. The geometrical standard deviation of the aerosol varied from 1.14 for the 1.3 microns aerosol to 1.5 for the 0.036 micron aerosol. The generator is simple in construction, stable in operation, and requires only a few minutes to reach a steady-state operating condition. The generator should be useful in those areas of aerosol research requiring the use of monodispersed aerosols. (Authors' Abs.)

932
Liu, B. Y. H., T. Whitby, and H. H. S. Yu.
DIFFUSION CHARGING OF AEROSOL PARTICLES AT LOW PRESSURES. Jour. Appl. Phys., v. 38: 1592-1597, 1967.

The diffusion charging of aerosol particles by unipolar ions was studied experimentally over the pressure range 0.0311 to 0.960 atmospheres, using monodispersed aerosols of di-octyl phthalate. The ratio, a/λ, of the particle radius to the mean free path of ions was varied over the range from 1.0 to 66. Within the accuracy of the experiments, the particle charge was independent of the ratio, a/λ, and well-represented by the equation, $n_p = 9.00D_p \ln (1 + 1.02 \times 10^{-5} N_0 t D_p)$, where n_p is the number of elementary units of charge acquired by the particle, D_p is the diameter of the particle in μ, N_0 is the number concentration of the ions to which the particle was exposed in ions/cc., and t is the charging time in seconds. This equation agrees with a theoretical equation derived by White when the molecular weights of the positive ions used in the charging experiments are assumed to be equal to 16 times that of air, or 460. (Chem. Abs.)

933
Liu, B. Y. H., K. T. Whitby, and H. H. S. Yu.
ON THE THEORY OF CHARGING OF AEROSOL PARTICLES BY UNIPOLAR IONS IN THE ABSENCE OF AN APPLIED ELECTRIC FIELD. Jour. Colloid Interface Sci., v. 23: 367-378, Mar. 1967.

The charging of aerosol particles by unipolar ions in a gaseous medium and in the absence of an applied electric field has been analyzed from the standpoint of the kinetic theory. The result has been compared and found to show good agreement with the experimental data, when the mean thermal speed of the corona ions used in the charging experiments is taken as 1.18 x 10^4 cm/sec. This is equivalent to assuming a value of 460 for the molecular weight of the ions. The molecular weight thus determined and the measured mobility of the ions of 1.1 cm^2/volt-sec at atmospheric pressure both tend to support the view that the corona ions used in the charging experiments are molecular clusters formed by the interaction of the charge and dipole moment of the molecules in the cluster. However, the exact nature of these molecular clusters could not be determined from the measurements made. The experimental data show that the charging process is unaffected by the mean free path of the ions and hence by pressure. This is in agreement with the result of the theoretical analysis based upon the method of kinetic theory of gases and is in variance with theories based upon the macroscopic diffusion of ions. It has also been shown that the predicted increase in the particle charging rate in Murphy's analysis is entirely the result of neglecting the curvature of the free path of ions in the vicinity of a charged particle. The correct equation, taking into account the curvature of the ion free path, agrees with an equation first derived by White. The failure of the theories based upon the solution of the continuous steady-state diffusion equation to account for the experimental facts has been shown to be due to the low concentration of ions normally encountered in any aerosol charging process and the essentially discontinuous nature of the charging process. (Authors' Abs.)

934
Lockhart, L. B., Jr.
"THE SIZE DISTRIBUTION OF RADIOACTIVE AEROSOLS." REPLY. Jour. Geophys. Res., v. 71: 6143-6144, 1966.

Lockhart states that the low flow rate deposition of artificial aerosols and the high air velocities used in the study of the polydisperse natural aerosol involve different mechanisms, so that C. E. Billings comparison is not valid. Additional data are presented in support of Lockhart's original hypothesis. (Chem. Abs.)

935
Lundgren, D.
A STATUS REPORT ON AEROSOL RESEARCH. Jour. Air Poll. Control Assoc., v. 17: 571, Sept. 1967.

This is a report on aerosol research presently underway in the United States. Based upon the special session on Aerosol Research presented under the aegis of TR 1 Research Committee at the 1967 APCA Annual Convention in Cleveland, it includes many additional studies which were not reported on at the session. It encompasses work done at universities, government agencies, and industrial organizations. There are many applications of the results of aerosol research to air pollution control. Among these are: the sampling and measurement of air pollutants, the regulation and control of air polluters, and the setting of criteria based on air pollution effects. Basic to air pollution is the presence of something undesirable in the air, or a pollutant. (Air Poll. Abs.)

936
Lundgren, D., and S. Calvert.
AEROSOL SAMPLING WITH A SIDE PORT PROBE. Amer. Indus. Hyg. Assoc. Jour., v. 28: 208-215, May-June 1967.

A most important consideration in determining particulate concentration in a gas stream is that of obtaining a true sample. An experimental investigation of a side port probe and a conventional sampling probe for obtaining aerosol samples from a duct is described. Sampling bias for both types of probe was determined experimentally over a wide range of test conditions using monodispersed aerosols from 0. 5 to 10 microns in diameter. Sampling bias was shown to be a function of the inertial impaction parameter and duct to probe velocity ratio. Experimental results are presented. Operational limits over which a sampling probe can be used are shown as a function of the permissible sampling error. (APTIC Abs.)

937
Lundgren, D., and D. Cooper.
EFFECTS OF HUMIDITY ON LIGHT-SCATTERING METHODS OF MEASURING PARTICLE CONCENTRATIONS. Jour. Air Poll. Control Assoc., v. 17: 592-593, Sept. 1967.

Using the amount of light scattered by airborne particles to estimate their concentration gives readings which are instantaneous, continuous, and easily-recorded. Visibility is inversely related to light scattering, so that the data from the two different but related measurements can be compared. Studies done with laboratory-generated aerosols have shown that, predictably, the diameters of hygroscopic aerosol particles increase with increasing humidity, especially after the change from solid to liquid phase has taken place. These studies used aerosols which were artificial in the sense that their compositions and concentrations would rarely be found outside the laboratory situation. (Air Poll. Abs.)

938
Lundgren, D. and W. Long.
PARTICLE SIZE-DISTRIBUTION DATA USING AN INERTIAL CLASSIFICATION-LIGHT SCATTERING DEVICE. Jour Air. Poll. Control Assoc., v. 17: 594, Sept. 1967.

The object of this study is to combine the particle size-fractionation ability of an inertial separation device (in order to obtain particle aerodynamic size) with the instant read-out capabilities of a total light-scattering photometer (in order to obtain instant particle size and concentration data). (Air Poll. Abs.)

939
Mockros, L. F., J. E. Quon, and A. T. Hjelmfelt, Jr.
COAGULATION OF A CONTINUOUSLY REINFORCED AEROSOL. Jour. Colloid Interface Sci., v. 23: 90-98, 1967.

Methods are given for the calculation of particle-size distribution of an aerosol with continuous feed, based on integration of the Smoluchowski equations with an added feed term. Various coagulation coefficients and feeds with various particle-size distributions were used. Among other things, the time to reach equilibrium is inversely proportional to the feed rate, while equilibrium is promoted more by heterogeneity of feed particle size than by size dependency of the coagulation coefficient. (Chem. Abs.)

940
Mukai, M., J. F. Thomas and D. Tebbens.
FATE OF AIRBORNE BENZO[A]PYRENE. Environ. Sci. & Technol., v. 2: 33-39, 1968.

Little is known of the fate of arenes in the atmosphere. To gain some knowledge of behavior of these arenes, benzo[a]-pyrene in solid phase was studied under various treatments. Ir analyses were used to describe the changes which occurred under treatment (900 to 700 cm.$^{-1}$ out-of-plane C—H bending vibration). Other isomers of B[a]P, perylene and B[e]P, and a few other polynuclear aromatic hydrocarbons did not show any changes in ir curves under the same treatments. Hypothetical structural analyses also were postulated regarding the soot and polynuclear aromatic hydrocarbons, as polynuclear aromatic hydrocarbons do not exist when there is no soot. (Chem. Abs.)

941
Pfeifer, R. J. and C. D. Hendricks.
CHARGE-TO-MASS RELATION FOR ELECTROHYDRODYNAMICALLY SPRAYED LIQUID DROPLETS. Phys. Fluids, v. 10: 2149-2154, 1967.

From a mathematical model suggested by Vonnegut and Neubauer relations between droplet radius and charge-to-mass ratio are developed for electrohydrodynamically sprayed liquid particles. Under the assumption that an unstable liquid mass disrupts into equally sized and charged particles so that the system energy tends toward a minimum value, probability distributions of the charge-to-mass ratio and the droplet radius are derived as modified Maxwell-Boltzmann functions; such functions explain certain features of experimentally observed distributions. That charged droplet systems tend toward a minimum energy configuration is verified by experimental evidence for Wood's metal, octoil, and glycerol. (Chem. Abs.)

942
Preining, O.
THE STOKES DIAMETER OF ELLIPSOIDAL PARTICLES. Atmos. Environ., v. 1: 271-286, 1967.

The Fuchs-Steechkina correction to the sedimentation velocity of spherical particles in the size range comparable to the mean free path was applied to ellipsoidal particles. Numerical values were computed for logarithmic increments of ~ 0.3 in size parameter x from $\log x = -2.0$ to 2.0, in the density ρ from $\log \rho = -1.3$ to 1.0, and in the eccentricity parameter β from $\log \beta = -1.3$ to 1.3. The resulting graphs permit the estimation of fall velocities or equivalent sphere diameters for particles in this size range which approximate ellipsoids. (Chem. Abs.)

943
Preining, O., D. Sheesley, and N. Djordjevic.
THE SIZE DISTRIBUTION OF AEROSOLS PRODUCED BY AIR-BLAST NEBULIZATION. Jour. Colloid Interface Sci., v. 23: 458-461, 1967.

Experiments are presented to prove indirectly that large numbers of small particles ($< 0.2\ \mu$) are present in any aerosol produced by air-blast nebulization. Both a simple medical nebulizer and a Corning bubbler were used to produce aerosols from NaCl solutions of different concentrations. An apparatus for the measurement of the aerosols is described. In air-blast nebulization there are always a large number of particles present below the resolution of an optical microscope. This fact must be considered in all experiments where small particles may influence the results, especially in nucleation studies. (Chem. Abs.)

944
Reist, P. C., and W. A. Burgess.
ATOMIZATION OF AQUEOUS SUSPENSIONS OF POLYSTYRENE LATEX PARTICLES. Jour. Colloid Interface Sci., v. 24: 271-273, 1967.

An apparatus is described for the dispersion of polystyrene latex (I) particles (0.557-2.68 μ) which serve as aerosol standards for the calibration of light-scattering-particle sensors. Methods of minimizing 2 sources of error are discussed. Secondary particles ($< 0.3\ \mu$), which are emulsifier particles evaporated from H_2O droplets containing no I, are eliminated by washing the I with ultrafiltered (0.1 μ) H_2O and filtering the H_2O and I through a membrane through which only the secondary aerosol passes. Increases in aerosol concentration with time are reduced by using a nebulizer that eliminates the nonaerosolized liquid, i.e. there is no refluxing, or keeps the nebulizer operating time at <30 min. (Chem. Abs.)

945
Sholtes, R. S.
AEROSOL RESEARCH EFFORTS AT THE UNIVERSITY OF FLORIDA. Jour. Air Poll. Control Assoc., v. 17: 598, Sept. 1967.

Previous experiments in the direct observation of aerosol behavior have been limited by the ability of the observer to accurately record the motion of fast-moving particles. Attempts to accomplish this objective through direct photography have been limited by film speed and physical limitations. At present research attempts to overcome these problems through the use of an image intensifying tube. The initial work involves the observation of particulates in a thermal gradient field. Later experiments will extend into observing aerosol behavior in other environmental situations. In each case the objective is to better define the physical parameters governing aerosol behavior. (Air Poll. Abs.)

946
Stein, F., N. Esmen, and M. Corn.
THE DENSITY OF URANINE AEROSOL PARTICLES.
Amer. Indus. Hyg. Assoc. Jour., v. 27: 428-430, Sept.-Oct. 1966.

A horizontal elutriator was used to determine the terminal settling velocity of spherical uranine particles generated by nebulization from a 1% water solution in a Dautrebande $D_{30}1$ generator. The best estimate of particle density calculated from terminal settling velocities was 0.58 gm/cm^3. The bulk density of the uranine powder used to prepare solutions was 1.53 gm/cm^3. This result is discussed with reference to the increased acceptance of uranine as a test aerosol and calibration standard. (Authors' Abs.)

947
Swift, D. L.
A STUDY OF THE SIZE AND MONODISPERSITY OF AEROSOLS PRODUCED IN A SINCLAIR-LA MER GENERATOR. Annals of Occupational Hygiene (Oxford), v. 10: 337-348, Oct. 1967.

Experiments were carried out to determine the effect of boiler and reheater temperature, flow rate, condensation conditions and concentration, and composition of nuclei upon the size and mondispersity of di-2-ethyl hexyl sebacate aerosols produced by a Sinclair-La Mer generator. Nine methods of producing nuclei are evaluated for their overall suitability. The monodispersity of aerosols is best when the condensation nuclei are chemically similar to the condensing vapor. (APTIC Abs.)

(b) Chemical and Physical Phenomena

948
Bellar, T. A., and J. E. Sigsby, Jr.
EVALUATION OF VARIOUS SILICA GELS IN GAS CHROMATOGRAPHIC ANALYSIS OF LIGHT HYDROCARBONS. Environ. Sci. & Technol., v. 1: 242-246, Mar. 1967.

Separations of light hydrocarbons obtained with columns packed with Davison silica gels (Types No. 08, 15, 35, 58, 62, 81, 113, and 950) are described. Experimentally, these silica gels were classified in two groups: (1) high activity silica gels with average pore diameter around 25 Å and (2) medium activity silica gels with average pore diameter around 150 Å. Light-hydrocarbon chromatograms characteristic of the two groups are shown. A system is described that can be used for analyzing C_1 to C_5 paraffins, C_2 to C_4 olefins, and acetylene in automotive emissions and in ambient air. (Eng. Index)

949
Charlson, R. J., and K. J. K. Buettner.
HUMIDITY SENSING DEVICES. U. S. Patent 3,273,402 (Cl 73-29). Apr. 25, 1967. 3p.

An apparatus comprising a pair of spaced gas permeable electrodes, a fluid-permeable body of substrate having a large ratio of surface-area-to-mass placed between the conductors, and carrying a coating layer of nonionizing hydroscopic liquid eliminates or alleviates hysteresis and poor repeatability in measuring the moisture content of a gas. Suitable substrate materials are nonhygroscopic, nonabsorbent polymeric solids having a dielectric constant < 4, such as granular poly-(tetrafluoroethylene)(Fluoropak), silica glasses, and other poly-unsaturates, as polyethylene, polypropylene, and polystyrene. Hygroscopic liquids suitable for the coating layer include polyethylene glycols, triethylene glycol dimethylether, tetramethylene glycol dimethylether and, at low temperature, glycerol. The thickness of liquid film on the substrate granules is typically of the order of 2500 Å. (Chem. Abs.)

950
Czanderna, A. W.
THERMODESORPTION STUDIES WITH A VACUUM MICROBALANCE. Vacuum Microbalance Techniques, v. 6: 129-148, 1966.

Theoretical equations are developed for analyzing thermodesorption data that were obtained with a vacuum microbalance. The results of thermodesorption of CO_2 from an O-covered Ag surface are plotted vs temperature. At 25 and 45°, CO_2 is absorbed on the available O atom sites; however, thermodesorption at <150° removed 10% of the adsorbed O, which cannot be removed unless the O-covered surface is exposed to CO_2. The maximum rate of CO_2 adsorption was reached at 75° and was independent of the initial concentration and the initial temperature of desorption, which is consistent with a 1st-order rate process. The desorption spectra at 75 and 100° are attributed to O desorption, and the maximum is a function of the initial desorption temperature and initial concentration. Thus, the desorption of O is qualitatively characteristic of a 2nd-order rate process. The advantages and disadvantages of using a microbalance for thermodesorption are compared with an ion gauge or filament technique. (Chem. Abs.)

951
Feldstein, M., S. Balestrieri, and D. A. Levaggi.
SILICA GEL IN SOURCE TESTING. Amer. Indus. Hyg. Assoc. Jour., v. 28: 381-385, 1967.

This study was concerned with the efficient collection of organic vapors on an adsorbent, and the quantitative removal of the adsorbate for analysis. The adsorption apparatus consisted of three probes (3/4 in. x 6 in.) containing 20 g of Davidson silica gel PA 400 (8 to 16 mesh, predried at 110-120° for 2 hr) arranged in series. By use of a constant-drive syringe pump, 25 to 50 μl of the organic material was injected into the flask. Larger volumes were injected manually over a 5-10 min period. The flask was heated by a heating mantle to 45-50°, or to 120° for higher boiling materials. Air was drawn through the flask and probes at 0.25 ft^3/min for 1 hr. The contents of the probes were then poured into separatory 125-ml Erlenmeyer flasks for desorption and analysis. For desorption, add 25 ml of desorbing solution, stopper, and let stand 2 hr with occasional shaking. Decant the solvent and store in a test tube. Inject 1-5 μl of eluate into the gas chromatograph equipped with a flame ionization detector. A column of 4 ft x 1/4 in. stainless steel tube filled with 20% Carbowax X20M on firebrick 60/80 mesh is used, with N as the carrier gas. Thus, at 78 ml/min N and 100°, a MeOAc peak will appear in 1.05 min. For ir analysis, transfer the eluate to a 0.1-mm cell and determined the wavelength of interest. Thus ketones and esters were determined by the 5.7 μ band. All ir analyses were made in CS_2. Simple compounds such as aromatic hydrocarbons, esters, and alcohols were determined by gas chromatography, whereas complex materials such as Stoddard solvent and VMP naphtha were analyzed by ir. Dimethylsulfuroxide was an efficient eluant for all the materials studied except for solvent mixtures such as Stoddard and naphtha, and hydrocarbons containing >8C. In the latter cases, an eluant of CS_2 and H_2O gave good recovery. One silica gel probe was sufficient for simple studies; in the case of field studies where sampling times may be longer, concentration of solvent is generally high, and greater quantities of H_2O may be present, the efficiency of adsorption is decreased, and it is advisable to use three probes in series. (Chem. Abs.)

952
Harkness, A. C., and B. A. Kelman.
SOLUBILITY OF METHYL MERCAPTAN IN WATER. TAPPI, v. 50: 13, Jan. 1967.

Solubility was determined by measuring the volume of gas absorbed at constant pressure. The solubility at 30°C was found to be 4.90 vol/vol/atm. The heat of solution was calculated to be -6.2 kcal/mole in the temperature range 0 to 50°C. The effect of added electrolytes on the solubility was determined. (Authors' Abs.)

953
Jones, G. E., and L. M. Kleppe.
SIMPLE AND INEXPENSIVE SYSTEM FOR MEASURING CONCENTRATIONS OF ATMOSPHERIC Rn^{222}. Univ. of California, Lawrence Radiation Lab., Berkeley, 1966, 21p. (Report No. UCRL-16952) (AEC Accession No. 41277)

A Rn^{222} sampling system was designed and built which uses a charcoal absorption technique for collecting and analyzing that gas in a simple, inexpensive, reliable way. Results of measurements made with the system, although only preliminary, are in agreement with data obtained by other investigators. (Chem. Abs.)

954
Low, M. J. D., and L. S. Argano.
SORPTION OF ACTIVATED HYDROGEN ON VYCOR GLASS. Jour. Vacuum Sci. Technol., v. 3: 324-328, 1966.

A flow system incorporating Pirani gages was used to measure the sorption of H activated by a radio frequency discharge by Vycor glass. The sorption was dependent on the pressure and the discharge intensity. A rapid, initial adsorption was followed by a slow sorption which obeyed a $t^{1/2}$ law but then decelerated. The kinetics of the thermal release of H from the Vycor also followed a $t^{1/2}$ law. The data suggest that a steady-state condition, dependent on the H-atom population in the gas phase, was established on the surface. Hydrogen diffused into the bulk, the rate being a function of the heating of the Vycor surface by H-atom recombination. Molecular H diffused to the surface when a sampl was heated. (Chem. Abs.)

955
Low, M. J. D., and P. Ramamurthy.
HYDROXYL GROUPS ON GERMANIA SURFACES. Chem. Commun., no. 20: 733-734, 1966.

The reaction of H_2O vapor with GeO_2 producing surface OH groups was studied by ir techniques. After exposure of the GeO_2 powder to H_2O vapor at 5 torr for 15 min, the ir spectrum of the specimen shows a broad band centered near 3500 cm^{-1}, typical of sorbed, H-bonded H_2O, and a sharp peak near 3670 cm^{-1} in the O-H region. The intensity of the sharp band increases if the specimen has been heated in H_2O vapor at 300°. The sharp band is retained after the broad band is removed by degassing at 390°, but can itself be removed by degassing at 500°. The sharp band is assigned to isolated OH groups on the GeO_2 surface. (Chem. Abs.)

956
Low, M. J. D., and P. Ramamurthy.
SURFACE P-OH GROUPS ON IMPREGNATED SILICAS. Chem. Commun., No. 12: 609, 1967.

Slurrying a highly-degassed silica such as Cab-o-Sil with P_2O_5 solution, drying, and degassing leads to the formation of a sharp band in the OH region near 3665 cm^{-1}. This band, eliminated by heating at 800°, reforms by sorbing H_2O or shifts to 2698 cm^{-1} by sorption of D_2O. The band is ascribed to surface P-OH stretch. Surface P-amine groups are formed on reaction with NH_2. The P-OH groups act as specific reaction sites. (Chem. Abs.)

957
Low, M. J. D., and N. Ramasubramanian.
THE ROLE OF SURFACE BORON AS ADSORPTION CENTER FOR THE SORPTION OF WATER BY POROUS GLASS. Jour. Phys. Chem., v. 71: 3077-3081, 1967.

The ir spectroscopic results of water sorbed on a variety of samples with porous glass surfaces of various degrees of dehydration indicate that the changes produced on well dehydroxylated porous surfaces by H_2O sorption were mainly associated with the surface B. The degassing temperatures which were higher than those of most previous work, were high enough to permit some diffusion of B to the glass surface. The B-OH band increased markedly in intensity and shifted to lower frequencies indicating that H_2O sorption produced a relatively large number of B-OH groups and that these were perturbed by H bonding to other hydroxyls and (or) adsorbed H_2O molecules. Surface B was involved in much of the sorption of H_2O on porous glass, the B-OH groups formed by the dissociative reaction and the postulated molecularly adsorbed species becoming themselves sites for further adsorption of H_2O by H bonding. (Chem. Abs.)

958
Low, M. J. D., N. Ramasubramanian, and P. Ramamurthy.
CONTAMINATION OF SILICAS DURING HIGH-TEMPERATURE DEGASSING IN VYCOR TUBES. Jour. Vacuum Sci. Technol., v. 4: 111-114, 1967.

Materials heated in vacuo at 800° in Vycor tubes may become contaminated. An ir absorption near 3702 cm^{-1} was produced if Cab-O-Sil was degassed at 800° in a Vycor cell, and then partially hydrated. The band was not produced with specimens degassed in quartz cells. A variety of experiments lend strong although indirect support to the conclusion that the band was due to surface B-OH groups, brought about through the contamination of the silica surface by B volatilized from the hot Vycor. Similar contamination can be expected to occur with all specimens heated at 800° in Vycor, but the effects of the contamination may not be readily discernible by means of ir spectra. (Chem. Abs.)

959
Low, M. J. D., N. Ramasubramanian, and V. V. Subba Rao.
REACTIONS OF AMMONIA WITH POROUS GLASS SURFACES.
Jour. Phys. Chem., v. 71: 1726-1734, 1967.

Infrared spectra of NH_3 sorbed on highly dehydroxylated, deuterated, and fluoridated porous glass were recorded. Two pairs of bands at 3409 and 3320 and at 3350 and 3308 cm^{-1} were atributed to physically adsorbed NH_3, H-bonded to the SiOH and BOH groups of the glass surface, respectively. Bands at 3368 and 3283 cm^{-1} were ascribed to a ⋮B-NH_3 complex. Two pairs of bands at 3569 and 3479 and 3459 cm^{-1} were ascribed to ⋮BNH_2 and ⋮SiNH_2 groups, respectively. A single band at 3455 cm^{-1} was tentatively assigned to the N-H stretching vibration of a secondary amine, the N atom being bonded to two surface B atoms. (Chem. Abs.)

960
Reist, P. C., M. W. First, and L. Silverman.
DIFFUSION-BROAD CONCEPT IN REACTOR CONTAINMENT.
(Contract Harvard School of Public Health, Boston, Mass.
AT(30)-1). (AEC Report No. NYO-841-6). 1966, 46p.

In an effort to develop a suitable diffusion board for application to problems of reactor containment, the Harvard Air Cleaning Laboratory staff has investigated a number of materials. These include a C-impregnated cellulose fiber, a rigid porous C material, special boards constructed from slagwool and glass fibers, as Al honeycomb structure (the so-called Harvard Diffusion Board), and a porous-lined mineral-fiber ceramic board. Although certain of the media possess the required efficiency for removing particulate radioactivity and I vapors, all have proven to be deficient in one or more basic aspects, the major one being the problem of steam clogging. Although this can be overcome by using preheated metallic filters (for example, copper wool), such an approach is not practical for application under emergency conditions. (Chem. Abs.)

961
Santoro, T. and G. Stotzky.
SORPTION BETWEEN MICROORGANISMS AND CLAY MINERALS AS DETERMINED BY THE ELECTRICAL SENSING ZONE PARTICLE ANALYZER. Canadian Journal of Microbiology (Ottawa), v. 14: 299-307, 1968.

Sorption between microbial cells and clay minerals was determined by measuring changes in particle size distribution with an electronic particle counter. Sorption increased as the valency of the cations present on the clay and in the suspending electrolyte increased. Neither the size, motility, or gram reaction of bacteria nor the size of the clay appeared to influence sorption. Sorption occurred between bacteria and montmorillonite homoionic to monovalent cations only at pH 2 to 4, but did not occur at any pH with yeast cells, which sorbed only in the presence of trivalent cations. Heat-killed cells of yeast lost their ability to sorb, whereas cells killed with benzalkonium chloride did not. The possible implications of these results in sorption of microorganisms in natural habitats are discussed. (Chem. Abs.)

962
Satterfield, C. N. and A. J. Frabetti, Jr.
SORPTION AND DIFFUSION OF GASEOUS HYDROCARBONS IN SYNTHETIC MORDENITE. A. I. Ch. E. Jour., v. 13: 731-738, 1967.

Diffusion coefficients for the C_1 to C_4 paraffin hydrocarbon gases in single crystals of the synthetic zeolite (molecular sieve) Na mordenite were determined from transient sorption rate and desorption rate measurements at 25° to 140°, and pressures of from 0 to 20 cm Hg and found to be of the order of 10^{-9} to 10^{-10} cm ^{2}/sec. Diffusion coefficients for desorption were from 3 to 60 times smaller than those for sorption. Activation energies for methane and ethane were 1.7 and 1.9 kcal/mole, respectively. Equilibrium sorption capacity and diffusion coefficients are markedly affected by the conditions of synthesis and by mechanical treatments such as grinding. For propane at 29° and at 2.0 cm Hg pressure, the sorption capacity of 2.5 μ crystals was only 50% of that in 21 by 21 by 33 μ crystals, and the diffusion coefficient was only 1/50 of that in the larger crystals. Light mechanical grinding of the larger crystals lowered the sorption capacity 30% and the diffusion coefficient by a factor of 35. (Chem. Abs.)

963
Tierney, G. P. and W. D. Conner.
HYGROSCOPIC EFFECTS ON WEIGHT DETERMINATIONS OF PARTICULATES COLLECTED ON GLASS-FIBER FILTERS. Amer. Indus. Hyg. Assoc. Jour., v. 28: 363-365, July-Aug. 1967.

The effect of relative humidity on the tare weight of glass-fiber filters was insignificant, but the effect on collected particulates was significant when the humidity exceeded 55%. When particulate samples were weighed at relative humidities below 55%, weight variations did not exceed 1%. (Authors' Abs.)

964
West, F. K., P. W. West, and T. V. Ramakrishna.
STABILIZATION AND DETERMINATION OF TRACES OF SILVER IN WATERS. Environ. Sci. & Technol., v. 1: 717-720, 1967.

A method was developed for the determination of silver in water in the ppm to ppb range. EDTA is employed to stabilize the sample to prevent adsorptive losses of the silver to container walls. Quantitative measurements are made by atomic absorption spectrometry on silver dithizonate complexes after they have been isolated and concentrated into ethyl propionate. The method is specific, convenient, accurate, and widely applicable. (Authors' Abs.)

965
Wohlers, H. C., H. Newstein and D. Daunis.
CARBON MONOXIDE AND SULFUR DIOXIDE ADSORPTION ON AND DESORPTION FROM GLASS, PLASTIC, AND METAL TUBINGS. Jour. Air Poll. Control Assoc., v. 17: 753-756, Nov. 1967.

A feasibility study was undertaken to determine the sorption characteristics of SO_2 and CO on various conduit materials of 1000 ft of tubing installed on a television tower to transport ambient air samples from different height level. Sorption studies were completed on 100 ft lengths of 1/2 in. diameter tubings of glass, Teflon, tygon, polypropylene, PVC piping, aluminum, and stainless steel. Tubing diameter, gas concentration, flowrate through tubing temperature, humidity, and effect of sorption with SO_2 and CO alone or together were investigated. (Eng. Index)

966
Wohlers, H. C., N. M. Trieff, H. Newstein and others.
SULFUR DIOXIDE ADSORPTION ON— AND DESORPTION FROM TEFLON, TYGON, GLASS, STAINLESS STEEL AND ALUMINUM TUBINGS. Atmos. Environ., v. 1: 121-130, Mar. 1967.

A feasibility study was undertaken to determine whether ambient levels of sulfur dioxide could be measured without adsorption or desorption through the 30. 5 m of 1. 27 cm (i. d.) tubings of teflon, tygon, glass, stainless steel and aluminum. Experimental parameters studied included: air flow rate through the tubing (1. 4 l/min and 28. 3 l/min), concentration of SO_2 (1 to 100 pphm vol.), temperature (20 and 35°C) and r. h. (17-53 per cent). The West-Gaeke method and midget bubbler technique were used to monitor for SO_2 at the beginning and at the end of the 30. 5 m of tubing. It was found that after a relatively short period of conditioning, the tubings neither adsorbed nor desorbed SO_2 under the experimental parameters tested. Teflon, glass and stainless steel did not need prior conditioning while tygon and aluminum did need conditioning. (Authors' Abs.)

(c) Reaction Kinetics and Mechanisms

967
Benson, S. W.
KINETIC AND SPECTROSCOPIC CONSTRAINTS ON THE ORIGIN OF THE MOLECULAR NITROGEN AFTERGLOW. Jour. Chem. Phys., v. 48: 1765-1768, 1968.

The large transition probability (10^{-1} to 10^{-2}) for curve crossing such as that which occurs in N_2 predissociation $N_2(^3B) \rightleftharpoons N_2(^5\Sigma)$, guarantees that the rotationally hot members of the 12th vibrational level of the B state $(^3B^{(12)})^{\neq}$ will always be in equilibrium with free N atoms without the intervention of a third body. A kinetic scheme is suggested for these species that includes rotational and vibrational quenching in competition with electronic quenching. Fast rotational quenching gives rise to pseudoequilibrium population of normal $^3B^{(12)}$ species. The equilibrium constant K_B for $2N \rightleftharpoons N_2(^2B^{(12)})$ is estimated at $10^{-1.2}$ l/mole = $10^{-22.9}$ cc/particle at 300°K with a negative activation energy of 2. 2 kcal/mole, in good accord with recent data. Using $10^{5.0\pm0.3}$ sec^{-1} as the measured radiative rate constant of the 12-8 transition yields an absolute emission intensity for this band of $10^{2.9\pm0.3}$ 1/mole sec = $10^{17.9\pm0.3}$ cc/mole sec, again in good accord with observation. The 11th, 10th, and 9th vibrational levels are populated by successive collisional deactivation of the 12th level. This collisional deactivation is in competition with electronic quenching. (Chem. Abs.)

968
Benson, S. W.
MECHANISM OF THE DIELS-ALDER REACTIONS OF BUTADIENE. Jour. Chem. Phys., v. 46: 4920-4926, June 1967.

Kinetic data on the pyrolysis of 1, 5-cycloöctadiene to give butadiene and 4-vinyl cyclohexene by parallel paths are analyzed and shown to be quantitatively consistent with a common biradical precursor, the octadien-2, 6, -diyl-1, 8 biradical. It is further shown that these data are in excellent agreement with independent studies of the reverse reactions; pyrolysis of 4-vinyl cyclohexene to butadiene and the dimerization of butadiene. A fourth study of the pyrolysis in solution of 1, 2-divinyl cyclobutane to give butadiene, 1, 5-cycloöctadiene, 4-vinyl cyclohexene, and cis-trans isomerization is shown to fit the same scheme with only minor modifications in two of the rate constants. The analysis tends support to the 12. 6-kcal assignment of the allyl stabilization energy. It also resolves an apparent anomaly in the rate parameters for the reverse Diels-Alder pyrolyses of cyclohexene, 3-methyl cyclohexene, and 4-vinyl cyclohexene. Arrhenius parameters for all the elementary rate constants are assigned and shown to be reasonable compared to similar processes. Important rotation-controlled rates in the scheme are examined and conclusions drawn about the contributions of different rotomeric forms of the biradical. (Author's Abs.)

969
Benson, S. W., and G. R. Haugen.
ESTIMATED ACTIVATION ENERGIES FOR THE FOUR-CENTER ADDITION REACTION OF H_2, HX, AND X_2 TO ACETYLENES. Jour. Phys. Chem., v. 70: 3336-3338, 1966.

The application of an electrostatic model to predict the activation energy (E) of the title reaction (X = F, Cl, Br, I) is described. The acetylenes HC:CH, MeC:CH (Markovnikov and anti-Markovnikov addition), and MeC:CMe are investigated. The transition state is considered an intimate semi ion pair with an equivalent charge separation of ± 0. 5 formal charge, with E equated to the electrostatic energy of interaction of point dipoles. The calculated E values are tabulated. (Chem. Abs.)

970
Benson, S. W., and G. R. Haugen.
MECHANISMS FOR SOME HIGH-TEMPERATURE GAS-PHASE REACTIONS OF ETHYLENE, ACETYLENE, AND BUTADIENE. Jour. Phys. Chem., v. 71: 1735-1746, May 1967.

Sufficient information concerning the rate parameters of the individual propagation and termination steps of radical reactions now exists so that it is possible to predict the kinetic behavior of a chain mechanism with better than order-of-magnitude reliability. This precision comes from the similarities that exist between the A factors and activation energies of homologous reactions. In particular, the creditability of a proposed chain mechanism for the high-temperature gas-phase reaction of unsaturated hydrocarbons can be tested by comparing the observed kinetic behavior with that predicted by the mechanism. A pyrolytic chain was proposed that adequately describes the experimentally observed high-temperature hydrogenation of acetylene and also the high-temperature pyrolysis of ethylene. The propagation steps representing the formation of the major products of these systems are diagrammed. The minor product in both systems is 1, 3-butadine. In the pyrolysis of ethylene, the side reaction accounts for the production of butadiene. In the case of the hydrogenation of acetylene, a concurrent chain is responsible for the side products. (APTIC Abs.)

971
Benson, S. W., and R. Shaw.
KINETICS AND MECHANISM OF THE PYROLYSIS OF 1, 4-CYCLOHEXADIENE. Trans. Faraday Soc., v. 63: 985-992, Apr. 1967.

The homogeneous gas-phase pyrolysis of 1, 4-cyclohexadiene has been shown to obey the pattern of reactivity of cyclic olefins. The reaction was studied using mass spectrometry, u.-v. spectroscopy, gas chromatography, and pressure measurements. The process is first order to at least 80% decomposition. The rate constant has been measured over a range of seven powers of ten, in packed and unpacked, static and flow reactors between 250 and 620°C and between 10^{-3} and 10^{2} torr. The absence of hydrogen atoms has been shown by the lack of exchange with hexadeuterobenzene and toluene. The chain decomposition involving cyclohexadienyl radicals is, therefore, not important, probably due to the endothermicity and low A-factor of the bimolecular initiation. From the Arrhenius parameters for the intramolecular elimination of hydrogen from 1, 4-CH, and from estimates of the entropy and heat changes, the rate constant for the dienophilic 1, 4-hydrogenation of benzene was calculated. (APTIC Abs.)

972
Benson, S. W., and R. Shaw.
KINETICS AND MECHANISM OF THE PYROLYSIS OF 1,3-CYCLOHEXADIENE. A THERMAL SOURCE OF CYCLOHEXADIENYL RADICALS AND HYDROGEN ATOMS. THE ADDITION OF HYDROGEN ATOMS TO BENZENE AND TOLUENE. Jour. Amer. Chem. Soc., v. 89: 5351-5354, Oct. 11, 1967.

The pyrolysis of 1,3-cyclohexadiene (1,3-CH) has been studied in a static system between 10 and 90 torr and 362 and 421°. The products were benzene, cyclohexene, hydrogen, and traces (less than 5%) of C_{12} hydrocarbons. At 391° and 40 torr initial pressure, the initial rate of reaction is $10^{-6.8}$ mole/l sec. The order is between one-half and three-halves and is close to five-fourths. The activation energy, obtained at constant (~40 torr) initial pressure, is 40± 5 kcal/mole. The rate of unaffected by added CF_4 is halved by increasing the surface-to-volume ratio 20 times. The observed products were accounted for by a chain mechanism involving hydrogen atoms, cyclohexadienyl radicals, and cyclohexenyl-3 radicals. The order, initial rate, and activation energy for the pyrolysis of 1,3-CH, calculated from the mechanism, were in reasonable agreement with experiment. (APTIC Abs.)

973
Benson, S. W., and G. N. Spokes.
VERY LOW-PRESSURE PYROLYSIS. I. KINETIC STUDIES OF HOMOGENEOUS REACTIONS AT THE MOLECULAR LEVEL. Jour. Amer. Chem. Soc., v. 89: 2525-2532, 1967.

Gases have been pyrolyzed in a very low-pressure environment in which attention has been given to the establishment of uniform temperature conditions, and energy transfer is predominantly via gas-wall collisions. The observed low-pressure and theoretical high-pressure decomposition rates of molecules of widely different chemical and structural character are compared. Complicated molecules with small activation energies are pyrolyzed into simpler products at a rate which is close to the high-pressure rate. Simpler molecules decompose more slowly at rates which become controlled by energy transfer. Wall catalysis is relatively unimportant in the process. Studies of the unimolecular decomposition of iso-BrI have given information on: (1) the energy accommodation between wall and molecule, (2) the effective number of Kassel oscillators deduced from a simple theoretical treatment of the data, and (3) the effects of wall conditioning on the decomposition rate. The kinetic equations for the steady-state condition in a stirred flow reactor at very low pressures are evaluated explicitly. These include the effects of induction periods due to "mixing" and to lack of attainment of a steady-state internal energy distribution. Preliminary results on iso-PrI indicate that about 80 wall collisions are needed to attain steady state at 900°K. (Chem. Abs.)

974

Benson, S. W., and G. N. Spokes.

VERY LOW PRESSURE PYROLYSIS. III. TERT-BUTYL HYDROPEROXIDE IN FUSED SILICA AND STAINLESS STEEL REACTORS. Jour. Phys. Chem., v. 72: 1182-1186, 1968.

The technique of very low pressure pyrolysis (VLPP) was applied to study the pyrolysis of tert-BuOOH in stainless steel and fused silica reactors over the temperature range 300-950°C. Evidence was found for both unimolecular and chain-type homogeneous reactions; the chain reaction involves free · OH radicals. Homogeneous reactions proceed very much faster than heterogeneous reactions in a fused-silica reactor. The products of the unimolecular reaction are acetone and water, together with some other low-mass (≤32 amu) substances (candidates are MeOH, CH_2O, CO, and H_2). The chain reaction yields, in addition, isobutylene oxide with H_2O. The acetone-production data lead to a rate constant for tert-BuOOH → tert-BuO + OH, in excellent agreement with lower temperature data and thermochemical estimate of a 43-kcal O—O bond. The total range covered is from 500 to 1000°K and 11 powers of 10 in the rate constant. Pyrolysis in a stainless steel reactor produces predominantly tert-BuOH + O_2. Smaller amounts of isobutylene and some acetone are also formed. This represents a heterogeneous reaction which is much faster than the homogeneous decomposition in silica. While the wall mechanism is uncertain, the high rate points to the existence of a loosely bound, physisorbed precursor which can undergo bond cleavage with a high A factor and a relatively low activation energy (i.e., ~ 10 kcal). (Chem. Abs.)

975

Cadle, R. D., and J. W. Powers.

THE REACTION OF $O(^3P)$ WITH ACETALDEHYDE IN A FAST-FLOW SYSTEM. Jour. Phys. Chem., v. 71: 1702-1706, 1967.

The kinetic and products of the reaction of $O(^3P)$ with AcH in a fast-flow system have been investigated. The only products detected under these conditions were CH_4, water, CO_2, CO, and a trace of HCHO. Rate constants were calculated from the initial rate of reaction of O(^{3}P), k_0, and from the over-rate of disappearance of AcH, k_a. Values of k_a were about twice those for k_0, for which the rate equation was found to be $k_0 = 1.1\ (\pm 0.3) \times 10^{13} \exp(-2300/RT)$ cc/mole-sec. Values for k_0 were essentially the same whether the atomic O was produced by titrating atomic N with NO or by subjecting molecular O to a microwave discharge. (Chem. Abs.)

976
Corcoran, W. H.
MECHANISM IN THE OXIDATION OF PARTS-PER-MILLION QUANTITIES OF NITRIC OXIDE. Ind. and Eng. Chem. Fundamentals, v. 7: 184, 1968.

The equation previously proposed by Morrison, Rinkla, and Corcoran (1966) for the oxidation rate of ppm NO quantities in the presence of N and O was revised to the form: $-dC_{NO}/dt = 2k_7K_3C_{NO}{}^2C_{O_2} + 2k_6K_4K_5C_{NO2}C_{O_2}$, where C is the concentration, t the time, and k and K are constants. The added factor of 2 in the 2nd term of the right side was due to the formation of both symmetrical-, and asymmetrical-NO_3. (Chem. Abs.)

977
Egger, K. W. and S. W. Benson.
SOME OBSERVATIONS ON THE KINETICS OF HYDROGEN IODIDE ADDITION TO 1, 3- AND 1, 4-PENTADIENE. Jour. Phys. Chem., v. 71: 1933-1936, May 1967.

Quantitative kinetic information on the addition of HI to olefins obtained complementary to reported studies of the I atom catalyzed isomerization and dimerization of n-pentadienes in the gas phase is reported. The rate of addition of HI to either 1, 3- or 1, 4-pentadiene was checked as a possible side reaction in these studies. It was found that, during the isomerization of 1, 4-pentadiene in the presence of I at temperatures between 420 and 515°K, 5-10% monolefins had been produced. Rate constants were calculated from pressure measurements, as only the rate-controlling step leads to a pressure change. The I buildup during the reaction, monitored spectromphtometrically, checks out within experimental error limits with the amount of saturated hydrocarbon or monolefin, respectively, measured by gas-liquid chromatography. The measured pressure changes are in reasonable agreement with the I produced. The method and experimental procedures used have been reported in detail earlier. The results are summarized here. A more careful and detailed study of the HI addition to 1,3-pentadiene is needed before any further conclusions can be drawn. There is no doubt, though, that HI adds much faster to the conjugated olefinic bond and it is believed that this corresponds to the homogeneous reaction rate. (APTIC Abs.)

978
Essenhigh, R. H.
THE INTER-INFLUENCE OF CLASSICAL HETEROGENEOUS COMBUSTION RESEARCH AND RELATED AEROSPACE PROBLEMS. In: 11th Symposium (Internat.) Combust., 1966. 1967, p. 291-305.

A review with references is presented. Seven areas in the ignition, pyrolysis, and combustion of solids are identified that require elucidation. (Chem. Abs.)

979
Felmeister, A., M. Amanat, and N. Weiner.
INTERACTION OF GASES WITH MONOLAYERS. Jour. Pharm. and Pharmacol., v. 18: 837-838, 1966.

Two apparently contradictory reports have been made by Clements and Wilson and by Evans, et al. about the effects of gaseous anesthetic agents on monomolecular films. Based on the authors' experience of the effects of gases on monolayers, the apparent differences in the results are probably directly traceable to basic differences in procedures and techniques. More meaningful information is obtained for the interactions of gases with film molecules when these are made on a single film whose surface area characteristics have first been established in the absence of the gases. The rates of compression should be slow enough to allow the molecules in the monolayer to maintain equilibrium orientations at all areas at which measurements are made. Furthermore, the film should never be compressed beyond the collapse pressure when further expansion-compression cyclying of the film is desired. When these experimental conditions are adhered to, effects of gases on films that result in small surface pressure changes can be easily detected. (Chem. Abs.)

980
Harkness, A. C. and F. E. Murray.
REACTION BETWEEN METHYL SULFIDE AND OXYGEN IN A STATIC SYSTEM. Atmos. Environ., v. 1: 491-497, July 1967.

Methyl sulfide and oxygen react explosively at temperatures as low as 210°C. At 195°C the non-explosive reaction exhibits an initiation stage and a main stage. The rate of the main stage as determined from pressure-time curves is linearly dependent on initial oxygen pressure but substantially independent of initial methyl sulfide pressure. The extent of the initiation stage is reduced by increase in the oxygen pressure. The chief oxidation products are sulfur dioxide and carbon monoxide. Even with an excess of oxygen not all methyl sulfide reacts. (Authors' Abs.)

981
Heicklen, J. and N. Cohen.
THE ROLE OF NITRIC OXIDE IN PHOTOCHEMISTRY. Aerospace Corp., El Segundo, Calif. Oct. 1966, 301 p. (Contract No. AF 04(695)100) (Report No. SSD-TR-66-190 and TR-1001 (2250-40)-4) AD 808580.

The gas phase chemistry of NO is reviewed for reactions of importance below about 300 C. Reactions of vibrationally and electronically excited NO and the reactions of NO with stable molecules, electronically excited molecules, atoms, ions, and free radicals are included. The fate of nitroso compounds is also discussed. A bibliography containing 464 references is listed. (APTIC Abs.)

982
Hess, L. D., J. L. Jacobson, K. Schaffner, and others.
STRUCTURE AND REACTIVITY IN THE VAPOR-PHASE PHOTOLYSIS OF KETONES. V. ALIPHATIC CYCLOPROPYL AND OLEFINIC KETONES. Jour. Amer. Chem. Soc., v. 89: 3684-3688, July 1967.

Vapor-phase irradiations of the aliphatic cyclopropyl and olefinic ketones, methyl cyclopropyl ketone (I), 1-cyclopropyl-2-propanone (II), 1-cyclopropyl-3-butanone (IV), and 1-penten-4-one (III) at 3120 A° and 120° have been carried out. Quantum yields of CO from the type I split are 0.04 for ketone I, 0.88 for ketone II, 0.71 for ketone IV and 0.60 for ketone III. Other primary photochemical processes in these ketones are the isomerization of cyclopropane in compounds I and II, and the type II split in compound IV. The data from these reactions together with previously reported results provide the basis for a coherent evaluation of the relationship between structure and photoreactivity in the vapor phase at 3130Å and 120° of the two series of closely related aliphatic and cyclic ketones which possess cyclopropyl and double bonds, respectively, in the α, β, and γ positions to the carbonyl group. (APTIC Abs.)

983
Jaffe, S., and F. S. Klein.
ISOTOPIC EXCHANGE REACTIONS OF ATOMIC OXYGEN PRODUCED BY THE PHOTOLYSIS OF NO_2 AT 3660 A.
Trans. Faraday Soc., v. 62: 3135-3141, 1966.

Isotopically labeled atomic O, produced by the photolysis of $N^{18}O_2$ at 3660 A, was allowed to react with CO, CO_2, N_2O, O, and $COCl_2$. The specific rate constants were determined for the process, $O^* + XO \rightarrow O^*X + O$. They are 6.2×10^{10} exp $[(-6900 \pm 700)/RT]$, 6.3×10^8 exp $[(-3500 \pm 200)/RT]$, 9.6×10^8 exp$[(-4400 \pm 800)/RT]$, and 3.9×10^9 exp $[(-1100 \pm 400)/RT]$ 1/mole sec for CO, CO_2, N_2O and O, respectively. (Chem. Abs.)

984
Johnston, H. S., and F. Cramarossa.
HIGHLY COMPLEX PHOTOCHEMICAL MECHANISMS. Advan. Photochem., v. 4: 1-24, 1966.

In the photolysis of propionaldehyde the molecular split occurs to some extent, but the principal mode of decomposition is into two radicals. Radical-radical reactions are of two kinds, recombination and disproportionation. For the recombination, there are six reactions and six different products. For the disproportionations, there are nine reactions but only six products (one of which is the reactant). Each of the products is produced by three different reactions; thus a kinetic study based on analysis of products alone will never characterize any of the reactions. Chain reactions are favored by high reactant concentration, low light intensities, and large rate constants for radical-molecule reactions (high temperature, low activation energy). At a given light intensity and reactant concentration, a reaction might be non-chain at low temperature and a chain reaction with substantially different products at high temperature. Typically, photochemists report quantum yield, the ratio of molecules of products formed to photons absorbed. This taking of ratios throws away the absolute value of the light absorption rate. A photochemical reaction involving three or more radicals may be simplified by careful selection of light intensity, reactant pressures, or temperature. Three cases are considered: (1) photolysis of acetaldehyde, (2) photolysis of acetone, and (3) photooxidation of acetone. In the photolysis of acetone, simplification has been achieved but in the photooxidation of acetone such simplification seems to be out of sight. (APTIC Abs.)

985
Johnston, H. S., G. E. McGraw, T. T. Paukert, and others.
MOLECULAR-MODULATION SPECTROMETRY. I. NEW METHOD FOR OBSERVING INFRARED SPECTRA OF FREE RADICALS. Proc. Nat. Acad. Sci., v. 57: 1146-1153, May 1967.

In complex chemical reactions involving three or more free radical intermediates, it is impossible to deduce a unique mechanism merely by chemical analysis of all products and reactants. The most promising source of information is spectroscopic observation of the free radical intermediates. The flash photolysis method obtains infrared spectra, producing high concentrations of the intermediate radicals by subjecting the parent gas to a short intense pulse of energy. There are limitations to this method which are improved upon by the molecular modulation technique. Here the photolyzing light is turned off and on continually, modulating slightly the concentration of the reactants, intermediates, and products. When the concentration of a chemical species is varied periodically, absorption which is due to this species is used to modulate a transmitted infrared beam intensity. Thus when scanning through the spectrum, the light intensity is modulated only when one passes through that region characteristic of a particular reaction member. This method gives the vibrational spectra and the lifetime of the radical. (APTIC Abs.)

986
Merryman, E. L., and A. Levy.
KINETICS OF SULFUR-OXIDE FORMATION IN FLAMES. II. LOW PRESSURE H_2S FLAMES. Jour. Air Poll. Control Assoc., v. 17: 800-806, 1967.

The microstructure of 1/10 and 1/20 atmosphere, lean H_2S-O_2-N_2 flames was developed by using the mass-spectrometric flame-sampling technique. The flame mechanism developed agrees with that determined from an earlier study on 1 atmosphere H_2S flames. The formation of SO_2 is primarily related to the production of SH and the ensuing oxidation steps $SH + O_2 = SO + OH$ and $SO + O_2 = SO_2 + O$. While there is some question whether the SO_2 formation occurs via an SO or an S_2O intermediate, the present study does not give direct support to the role of S_2O in the oxidation mechanism. However, the presence of significant quantities of free S in the preflame zone may be indicative of S_2O formation via $SO + S \rightarrow S_2O$, and, possibly, via the disproportionation of SO, $3SO \rightarrow S_2O + SO_2$. Kinetic analyses of some of the preflame reactions indicate an apparent activation energy of 17, 300 cal/mole for the decomposition of H_2S. The actual initiation process in the flame mechanism requires further examination. The specific rate for the reaction step $H_2S + O = OH + SH$ is given by $k_6 = 1.45 \times 10^{15}$ exp (-6600/RT)cc/mole sec, and the specific rate for the oxidation of SO, $SO + O_2 = SO_2 + O$, is given by $k_5 = 5.2 \times 10^{14}$ exp (-19, 300/RT)cc/mole sec. (Chem. Abs.)

987
O'Neal, H. E. and S. W. Benson.
A METHOD FOR ESTIMATING THE ARRHENIUS A FACTORS FOR FOUR-AND SIX-CENTER UNIMOLECULAR REACTIONS.
Jour. Phys. Chem., v. 71: 2903-2921, Aug. 1967.

The Arrhenius A factors for gas-phase, unimolecular reactions which proceed through a cyclic transition state are examined from the point of view of transition-state theory and are shown to be compatible with a structure which is looser than the ring prototypes. On the basis of a few simple rules for assigning bending, stretching, and torsion frequencies it is shown that quantitative estimates of these A factors can be made to within the average experimental uncertainty of ± 0. 3 unit in log A (units of sec^{-1}). The extreme range of A values extends over 6. 0 log units. In a few isolated cases the discrepancy between estimated and observed A factors exceeds 1. 0 log unit and the weight of evidence suggests that the experimental values may not be reliable. The reactions include dehydrohalo-genations which go through four-center transition states, ester pyrolyses, "Ene" reactions, which go through six-center transition states, and Cope rearrangements which do the same. The analysis confirms previous suggestions that the most important contributions to $\Delta S \pm$ come from losses in hindered internal rotations (about -4. 0 gibbs/mole/rotor) in forming the loose cyclic structure. However, other coupled changes in structure can also be important. (APTIC Abs.)

988
Rich, S.
CHEMISTRY OF FUNGICIDES. In: Symposium on Pesticides: Their Effects on Soils and Water, Columbus, Ohio, 1965. 1966, p. 44-48.

The possible modes of action of fungicides are discussed. Once exposed to the environment, a fungicide can undergo a number of chemical and physical changes such as oxidation, hydrolysis, photolysis, carbonization, leaching, or vaporization. These processes sometimes convert the fungicides into more toxic compounds and sometimes into nontoxic compounds. The effects of sunlight, temperature, and soil pH on fungitoxicity are discussed. Some fungicides have species specificity. It is suggested that the most important site of action of fungicides is their interaction with amino and SH groups of enzymes inside the fungal cells. (Chem. Abs.)

989
Rodger, A. S., D. M. Golden, and S. W. Benson.
KINETICS OF THE REACTION OF IODOBENZENE AND HYDROGEN IODIDE. THE HEAT OF FORMATION OF THE PHENYL RADICAL AND ITS IMPLICATIONS ON THE REACTIVITY OF BENZENE. Jour. Amer. Chem. Soc., v. 89: 4578-4583, Aug. 1967. (Presented in part at: 2nd Western Regional Meeting, Amer. Chem. Soc., San Francisco, Calif., Oct. 1966 and at: 153rd Nat. Meeting, Amer. Chem. Soc., Miami, Fla., Apr. 1967).

The kinetics of the reaction of iodobenzene were studied in the gas phase from 375 to 500°. The rate data were consistent with the free-radical mechanisms. The result is 5 to 10 kcal/mole higher than previous literature values, but nevertheless is found to be consistent with kinetic data on the pyrolysis of iodo- and bromobenzene. The discrepancy between the present work and data from radical "abstraction" reactions from benzene cannot be reconciled, indicating that these reactions proceed by a complex mechanism. A mechanism for "abstraction" from benzene is proposed and illustrated for the thermal chlorination and bromination of substantial benzenes. It is shown to be in quantitative, as well as qualitative, agreement with the available data. (APTIC Abs.)

990
Setser, D. W.
VIBRATIONALLY EXCITED 1, 2-DICHLOROETHANE PRODUCED BY THE MERCURY PHOTOSENSITIZATION OF DICHLOROMETHANE. Jour. Amer. Chem. Soc., v. 90: 582-587, 1968.

The Hg photosensitization of H_2CCl_2 has been examined as a prototype method for generating chemically activated alkyl halide molecules. If the Cl atoms are removed from the reaction system by a suitable scavenger, then the measured nonequilibrium unimolecular rate constant for HCl elimination from the chemically activated 1, 2-dichloroethane formed by association of chloromethyl radicals agrees well with previously determined values. Some discussion of the reactions between the various Cl-substituted alkyl radicals that may occur in the propene-inhibited system is presented. The chemically activated 1, 3-dichloro-2-methylpropane formed by association of chloromethyl and 1-chloroisopropyl radicals does not undergo unimolecular reaction down to pressures of 2 mm. Calculated estimates for the HCl elimination rate constant from 1, 3-dichloro-2-methylpropane support this observation; similar calculations were also done for n-chloropropane. (Chem. Abs.)

991
Setser, D. W., and J. C. Hassler.
COLLISIONAL DEACTIVATION OF 1, 2-DICHLOROETHANE MOLECULES CONTAINING 89 KCAL. MOLE^{-1} OF VIBRATIONAL ENERGY. Jour. Phys. Chem., v. 71: 1364-1373, 1967.

The combination reaction of chloromethyl radicals was used to generate 1, 2-dichloroethane molecules with an average energy of 89 kcal/mole dilutely dispersed in an inert gas bath at 25°. By measuring the ratio of decomposition product (vinyl chloride) to stabilization product (1, 2-dichloroethane) at low pressures, the vibrational collisional transition probabilities were estimated for MeCl, CH_2Cl_2, CF_4, N, and Ar with the highly energized $C_2H_4Cl_2$ molecules. Based upon a simple stepladder deactivation model, the average increment of energy transferred per gas kinetic collision is ~10 kcal/mole for MeCl, CH_2Cl_2, and CF_4 and ~ 6 kcal/mole for N and Ar. These data concur with previous work which emphasized that highly vibrationally excited polyatomic molecules rapidly lose vibrational energy in collisions. The similar, but probably not equal, deactivation efficiency of CF_4 compared to MeCl or CH_2Cl_2 with 1, 2-dichloroethane suggests that dipole-dipole type interactions are not unduly important for vibrational energy transfer from highly excited polyatomic molecules, at least not for these examples. (Chem. Abs.)

992
Squires, A. M.
METHOD AND APPARATUS FOR PRODUCING OXYGEN AND POWER. U. S. Patent 3, 324, 654 (Cl. 60-39. 02) June 13, 1967, 13p.

A process is claimed for the production of O from dry, compressed air by a process of absorption onto a static bed of Ba and Mg oxides. The solid is heated by the exothermic absorption reaction, and after a major part of the solid reaches a temperature at which no more O can be taken up, the air is withdrawn. O is then allowed to desorb from the solid at a lower pressure, thereby cooling the solid. (Chem. Abs.)

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ADDENDUM

This Addendum extends the coverage of the bibliography to the air pollution literature appearing in the last quarter of 1968 (and even January 1969, in a few cases).

For ease in browsing, the Addendum has been arranged under the same broad headings as the preceding material. Page references to these broad headings will be found in the Table of Contents. The entries of the Addendum are not covered by the author or subject indexes.

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GENERAL ASPECTS

1A
Haagen-Smit, A. J.
AIR CONSERVATION. Scientia (Milan), v. 103: 261-280, May-June, 1968.

A general discussion is given on the increasing pollution of the atmosphere by industrial combustion of fuels, by automobile exhausts, and by burning of wastes. The following are considered: damaging effects on human health and some agricultural crops and forest trees; accelerated deterioration of numerous exposed materials; formation and composition of smog; and changes in the composition of pollutants in the air by action of oxygen and O_3. (Chem. Abs.)

2A
Heller, A. N.
HOW AN AIR POLLUTION INCIDENT IS COMBATTED. Industrial Med. and Surg., v. 37: 593-597, Aug. 1968.

The operation of an air pollution control system is described. Municipal, state and national agencies cooperate in warnings and remidial action. Some of the topics discussed are: (1) action during watch and alert; (2) first test in action; (3) the January 1967 inversion; (4) the August watch; and (5) lessons learned from experience.

3A
MIDDLETON TALKS ABOUT....
Environ. Sci. and Technol., v. 2: 734, 736, Oct. 1968.

A resumé of what is being done about air pollution at the National Air Pollution Control Administration is presented. Air quality criteria dealing with specific pollutants are published in blocs at one time during the year to simplify the tasks of the state. No criteria is published for which control techniques cannot be supplied. Much effort has been and is being put into the problem of measuring air quality. A retrieval system has been developed for air quality data throughout the country. A national program including the national effort and cooperation from the private section (contractual work and advisory capabilities) is being developed. The control of vehicle emissions and the necessity of coordinating federal agencies are discussed briefly.

4A
Alpiser, F. M.
AIR POLLUTION FROM DISPOSAL OF JUNK AUTOS. Air Eng., v. 10: 18-22, Nov. 1968.

A summary of a report on a NCAPC study on the disposal of junk automobiles and air pollution from such disposal is presented. Special attention is given to the magnitude of the auto disposal problem, auto stripping, auto disposal processes (incineration, its control devices and disintegration), and new auto disposal developments.

5A
Bailor, W. C. and J. D'Imperio.
INSECTICIDE MANUFACTURE. In: Air Pollution Engineering Manual, Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 787-792. (PHS Publ. No. 999-AP-40).

The manufacturing processes for solid dust and liquid spray insecticides are outlined. Threshold concentrations for continuous exposures are listed for various common pesticides. Emission of pollutants is in the form of very fine dusts or mists. Control equipment frequently used are bag filters and spray or packed scrubbers. (APTIC Abs.)

6A
Danielson, J. A. and R. S. Brown, Jr.
HOT-MIX ASPHALT PAVING BATCH PLANTS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 325-334. (PHS Publ. No. 999-AP-40).

Pertinent information is presented on the raw materials used, basic equipment, plant operation, the air pollution problems, hooding and ventilation requirements, and air pollution control equipment in hot-mix asphalt paving batch plants. The largest source of dust emissions in the hot-mix asphalt paving plant is the rotary drier. Other sources are the hot aggregate bucket elevator, the vibrating screens, the hot aggregate bins, the aggregate weigh hopper, and the mixer. Rotary drier emissions up to 6700 lb/hr have been measured. Drier dust emissions increase with air mass velocity, increased rate of rotation, and feed rate. Particle size distribution has an appreciable effect on the discharge of dust. Tests show that about 55% of the minus 200 mesh fraction in the drier feed can be lost in processing. The dust emission from secondary sources varies with the amount of fine material in the feed and the mechanical condition of the equipment. Dust pick-up must be provided at all sources of dust dis charge. Primary dust collectors usually consist of a cyclone. Twin or multiple cyclones are also used. The catch of the primary dust collector is returned to the hot bucket elevator where it continues on with the main bulk of the drier aggregate. The air discharged from the primary dust collector is ducted to the final dust collection system. Two principle types of final control equipment are the multiple centrifugal-type spray chamber and the baffle-type spray tower. The multiple centrifugal-type spray chamber has proved the more efficient. Variables affecting scrubber efficiency are discussed. Collection efficiencies of cyclonic type precleaners vary from approximately 70-90% on an over-all weight basis. Scrubber efficiencies varying from 85 to nearly 100% have been found. Over-all collection efficiency usually varies between 95 and 100%. A typical system consisting of a 12 ft diameter cyclone, a twin or triple tube scrubber complete with ductwork, water pump, and fan will cost about $25,000 for a plant capable of handling 6000 lb batches. If a multiple cyclone and provisions for recirculating the water are added the total cost may approach $45,000. Several tables and figures are included. (APTIC Abs.)

7A

Douglass, I. B. and L. Price.

SOURCES OF ODOR IN THE KRAFT PROCESS. II. REACTIONS FORMING HYDROGEN SULFIDE IN THE RECOVERY FURNACE.
Tappi, v. 51: 465-467, Oct. 1968.

In the recovery furnace concentrated black liquor loses its remaining water and the residual solids then undergo pyrolysis. One may assume that the black liquor solids consist of lignin- and carbohydrate-derived organics and various inorganic sulfur-containing substances such as sodium sulfate, sodium sulfite, sodium thiosulfate, sodium sulfide, or elemental sulfur. In two series of experiments, each of the inorganic substances listed was heated at 600°C, first with soda lignin and then with glucose. In the experiments using sodium sulfate and sodium sulfite, negligible amounts of hydrogen sulfide were formed. In the experiments with elemental sulfur, sodium sulfide, and sodium thiosulfate, however, heating with soda lignin or glucose caused 30-75% of the inorganic sulfur to be converted to hydrogen sulfide. These results clearly indicate that in a recovery furnace large volumes of hydrogen sulfide are formed which, if the furnace is not operated properly, may escape to the atmosphere and be a major cause of air pollution. (Authors' Abs.)

8A
Ahlquist, N. C. and R. J. Charlson.
MEASUREMENT OF THE VERTICAL AND HORIZONTAL PROFILE OF AEROSOL CONCENTRATION IN URBAN AIR WITH THE INTEGRATING NEPHELOMETER. Environ. Sci. and Technol., v. 2: 363-366, May 1968.

The integrating nephelometer was successfully adapted for rapid mobile monitoring of the atmospheric extinction coefficient due to scatter. The instrument was used to measure horizontal profiles of a city as well as to make vertical soundings. The instrument (particularly the adaptation for a 1-second time constant) is described in detail. Horizontal profile data obtained with the instrument mounted on an automobile show that it may be possible to consider a city as an entity rather than a set of unconnected monitoring sites. Vertical sounding data are also presented showing considerable structure that should be of use to the meterologists. (Authors' Abs.)

9A
Altshuller, A. P., S. L. Kopczynskii, W. A. Lonneman and others.
PHOTOOXIDATION OF PROPYLENE WITH NITROGEN OXIDE IN PRESENCE OF SULFUR DIOXIDE. Environ. Sci. and Technol., v. 2: 696-698, Sept. 1968.

The formation of light-scattering aerosol was investigated in a number of systems containing hydrocarbon, nitrogen oxides, and sulfur dioxide. Photooxidation of 2 ppm of propylene and 0. 5 ppm of nitrogen oxide was investigated under dynamic flow conditions with sulfur dioxide present in reaction mixtures at concentrations from 0. 0 to 1. 2 ppm. Statistical tests showed no significant differences in rates of consumption of propylene and nitrogen oxide or in yields of oxidant, peroxyacetyl nitrate, formaldehyde, and acetaldehyde. (Eng. Index)

10A
Charlson, R. J., N. C. Ahlquist, and H. Horvath.
IN THE GENERALITY OF CORRELATION OF ATMOSPHERIC AEROSOL MASS CONCENTRATION AND LIGHT SCATTER. Atmos. Environ., v. 2: 455-464, Sept. 1968.

A series of simultaneous mass concentration and light scattering measurements has been conducted in several locations with widely varying types and amounts of aerosol. The results indicate that the relationship between mass concentration and the extinction coefficient due to scatter is the same for all locations. The approximately constant proportionality implies that the size distribution of the aerosol is relatively reproducible. If the results are put into the form of the product of meteorological range and mass concentration, the mass of material necessary to determine the meteorological range is distributed about a model value of 1.2 g/m^2. (Authors' Abs.)

11A
Middleton, J. T.
AIR QUALITY AS A CONTROLLING FACTOR IN IN LIFE PROCESSES. In: Biometeorology. Ed. by W. P. Lowry. Corvallis, Oregon State University Press, 1968, p. 67-79. (Proc. 28th Annual Biology Colloquium, 1967).

"Airsheds" are logical and realistic boundaries within which air is used and polluted by related aggregates of people and their activities. By studying these airheads, the quality of polluted air may be established. The effects of leading air pollutants (ethylene, fluorides, nitrogen dioxide, ozone, peroxacetyl nitrate and sulfur dioxide) on biological receptors are briefly discussed. The problem of pollution control and decision making is also explored.

12A
Noll, K. E., P. K. Mueller, and M. Imada.
VISIBILITY AND AEROSOL CONCENTRATION IN URBAN AIR. Atmos. Environ., v. 2: 465-475, Sept. 1968.

A quantitative relationship between visibility and mass concentration of particulate matter in urban air has been developed. Data from California, Missouri and Washington were used to show that the concentration was inversely proportional to visibility ($V = K/M$) and that the constant of proportionality was between 6.1×10^2 and 12×10^2 μg $mile/m^3$ when the visibility was recorded in miles and the concentration was in $\mu g/m^3$. In terms of c.g.s. units K was 1.0-1.9 g/m^2. A visibility of 10 miles had an average particulate loading near 100 $\mu g/m^3$ while a visibility of 3 miles had an average loading near 300 $\mu g/m^3$ when data from all of the studies were combined. (Authors' Abs.)

MEASUREMENT

13A
Ludwig, F. L. and E. Robinson.
VARIATIONS IN THE SIZE DISTRIBUTIONS OF SULFUR-CONTAINING COMPOUNDS IN URBAN AEROSOLS. Atmos. Environ., v. 2: 13-23, Jan. 1968.

A program of aerosol collection was conducted with the Goetz

Aerosol Spectrometer in the Los Angeles and San Francisco Bay areas during the spring and summer of 1964 and 1965. These collections yielded more than seventy individual size distributions of sulfur-compound particulates. Weighted averages, calculated from the individual collections, are presented for data classified according to humidity, time of day, and location. A typical size distribution for all the data would have a mass median equivalent diameter of about 0.35 μ with upper and lower quartiles at about 1.0 and 0.1 μ, respectively. Sulfur-compound aerosols collected during periods of high humidity had a substantially higher average mass median diameter than those collected under low humidity conditions. A limited number of round-the-clock samples indicated that the average size of the particles generally was largest in the forenoon, decreased in the afternoon and evening, and then increased again during the early morning. There was some variability among the average size distributions for different sampling locations. (Authors' Abs.)

14A
Luedtke, K. D.
Appendix B. ODOR-TESTING TECHNIQUES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 861-864. (PHS Publ. No. 999-AP-40).

The use of an odor panel for the evaluation of odor is commonly employed. A panel has 6-8 subjects so that average results can be obtained. Techniques of odor sample dilution and odor sampling are discussed. A method of analyzing the experimental results is demonstrated with typical test data. (APTIC Abs.)

15A
Pritchard, W. L., C. E. Schumann, and C. W. Gruber.
WIND TUNNEL EVALUATION OF ADHESIVE-COATED CYLINDERS AS COLLECTION MEDIA IN PARTICULATE SAMPLING. Amer. Indus. Hyg. Assoc. Jour., v. 29: 343-349, July-Aug. 1968.

The collection efficiencies of an adhesive-coated cylindrical sample were determined under controlled conditions with the aid of a specially constructed laboratory wind tunnel in which wind speeds could be varied between 5 mph and 40 mph. For size distributions having mean diameters of 31 to 36 microns, collection efficiencies were 24% at 5 mph, 37% at 10 mph, and 54% at 15 mph. Particle deposition was greatest in the leading 45° sector, dropping off sharply downwind of that region. (Authors' Abs.)

16A
Sawicki, E., M. Guyer, and R. Schumacher.
ELECTROPHORETIC AND CHROMATOGRAPHIC SEPARATION AND FLUORIMETRIC ANALYSIS OF POLYNUCLEAR PHENOLS. APPLICATION TO AIR POLLUTION. Mikrochimica Acta (Wien), v. 3: 1025-1039, 1968.

Thin-layer chromatographic and low-voltage and high-voltage electrophoresis procedures are described for a series of polynuclear aromatic and heteroaromatic phenols. Location methods of various types are described. The following phenols were identified in coal-tar-pitch: 1-naphthol, 2-naphthol, 2-hydroxybiphenyl, 4-hydroxybiphenyl, 2-fluorenol, 3-fluorenol, 2-hydroxydibenzofuran, and 2-hydorxycarbazole. 2-Fluorenol was also found in a particulate sample of New York City air. A large number of unidentified fluorescent spots, characterized as phenols, were found in coal-tar-pitch and various airborne particulate samples from urban areas. (Chem. Abs.)

17A
Stanley, T. W., M. J. Morgan, and E. M. Grisby.
APPLICATION OF RAPID THIN-LAYER CHROMATOGRAPHIC PRO PROCEDURE TO DETERMINATION OF BENZO(A)PYRENE, BENZ(C)ACRIDINES, AND 7H-BENZ(D)ANTHRACEN-7-ONE IN AIRBORNE PARTICULATES FROM MANY AMERICAN CITIES. Environ. Sci. and Technol., v. 2: 699-702, Sept. 1968.

Simple one-dimensional thin-layer chromatographic procedure was used to determine three compounds representing different classes of pollutants associated with airborne particulates. Benzol(a)pyrene, benz(c)acridine, and 7H-benz(de)anthracen-7-one were separated from crude benzene extracts of air particulates on thin layers of alumina mixed with silica gel. Crude benzene extracts of particulates collected from more than 50 American cities were analyzed. (Eng. Index)

CONTROL METHODS

18A
Adrian, R. C.
TWO-STAGE ELECTRICAL PRECIPITATORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 156-166. (PHS Publ. No. 999-AP-40).

The two-stage electrostatic precipitator is discussed in terms of the theoretical aspects, design factors, construction and design, applications, special design, and equipment selection. Included in the discussion are the following: the physics of dust separation; particle charge; drift velocity; efficiency; electrical requirements, auxiliary controls; assembly, maintenance, and safety. Two-stage precipitators are widely used for removing oil mist. Among the types of operations that have been successfully controlled by standard two-stage precipitators are high-speed grinding machines, meat product smokehouses, continuous deep-fat cookers, asphalt saturation, galvanizing kettles, rubber curing ovens, carpet dryers, and vacuum pumps. The emissions from all these operations include at least some oil mist. Oils have a relatively high drift velocity and probably act as a conditioning medium for less conductive emissions. In addition, the oils deposited on the collection plates prevent reentrainment of collected dust or fumes. Velocity and ionization conditions that have been found adequate for air pollution control purposes are listed. Since many factors must be considered in designing or selecting a two-stage unit for a given process, some field experience with the characteristics of the air contaminant is necessary. In addition a broad experience in precipitation work is essential. If data on the specific process to be controlled are lacking, then pilot or laboratory-scale information must often be obtained before a full-size unit is installed. Once the pertinent data have been collected, the general physical dimensions and electric requirements of the precipitator can be determined by the equations presented. (APTIC Abs.)

19A
Barber, J. C.
AIR POLLUTION. THE COST OF POLLUTION CONTROL. Chem. Eng. Progr., v. 64: 78-82, Sept. 1968.

Changes in the economics of fertilizer production favor increasing use of the electric furnace method over the wet process method. The adequate control of airborne wastes from phosphorus furnaces and phosphoric acid units therefore becomes increasingly important. These airborne wastes are potential pollutants as they may cause industrial hygiene problems and give unsightly plant appearances. The problems of waste discharge at phosphorus furnaces and phosphoric acid units are discussed. Some of the methods and facilities used to control these wastes are reviewed. (APCA Abs.)

20A
Chatfield, H. E.
RESIN KETTLES. In: Air Pollution Engineering Manual. Air Pollu-Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 681-688. (PHS Publ. No. 999-AP-40).

Aspects of resin (plastic) production such as chemical reactions, reaction conditions, equipment, and operating procedures are discussed for phenolic, amino, polyester, and alkyd, polyurethane, polyvinyl, polystyrene, and petroleum and coal tar plastics. The principal air contaminants and sources of emission from resin manufacturing operations are tabulated. The usual emission control equipment types are cyclones and spray towers for particulates, and reflux condensers and water scrubbers for solvent fumes. (APTIC Abs.)

21A
Chatfield, H. E.
VARNISH COOKERS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 688-695. (PHS Publ. No. 999-AP-40).

Varnish is a homogeneous, heat-processed blend of drying oil, resin, drier, and solvent. The ingredients are mixed in a heated bottle from 8 to 12 hours at temperatures from 200° to 600°F. Emissions average 3 to 6% of the batch and include water vapor, fatty acids, glycerine, acrolein, phenols, aldehydes, ketones, terpene oils, terpenes, and carbon dioxide. Exhaust hoods placed over the kettles lead to such emission control equipment as water scrubbers, activated charcoal adsorbers, and flame and catalytic afterburners. Proper design, operating conditions, effectiveness, and limitations are discussed for hoods and each type of emission control equipment. (APTIC Abs.)

22A
Chatfield, H. E. and R. M. Ingels.
GAS ABSORPTION EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 210-232. (PHS Publ. No. 999-AP-40).

Gas absorption equipment is designed to provide thorough contact between the gas and liquid solvent in order to permit interphase diffusion of the materials. This contact between gas and liquid can be accomplished by dispersing gas in liquid or vice versa. Absorbers that disperse liquid include packed towers, spray towers and venturi absorbers. Equipments that uses gas dispersion includes plate or tray towers and vessels with sparging equipment. The principles of designing plate towers and packed towers are discussed in detail. The following items are included in the discussion on packed towers: packing materials, liquid dispersion, tower capacity, tower diameter, number of transfer units, height of a transfer unit, and pressure drop through packing. An example of calculations involved in designing a packed tower for the removal of NH_3 is illustrated. Liquid flow, plate design and efficiency, flooding, liquid gradient on plate, plate spacing, tower diameter, and the number of theoretical plates are included in the discussion of plate calculations involved in determining the number of plates required and estimated diameter of a plate tower is illustrated. The choice of gas absorption equipment is usually between a packed tower and a plate tower. Both devices have advantages and disadvantages. Factors which the final selection should be based upon are listed. Spray-type absorbers and venturi absorbers are also briefly discussed. These towers are primarily used for removing particulates from gas streams, though they have some gas absorption applications. The gaseous aid contaminants most commonly controlled by absorption include SO_2, NH_3, NO_x, and light hydrocarbons. (APTIC Abs.)

23A
Cuffe, S. T.
CATALYST REGENERATION. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 642-652. (PHS Publ. No. 999-AP-40).

The regeneration of catalysts employed in petroleum refining processes, such as fluid and Thermofor catalytic cracking, is accomplished by burning coke and sulfur deposits from the catalyst surface. Combustion gases from regeneration include the pollutants CO, SO_x, NO_x, NH_3, hydrocarbons, and particulate matter. Tables of data collected in 1956 are presented which specify process flow rates, catalyst circulation rates, regeneration air rates, coke burnoff rates, flue gas temperatures, particulate losses, hydrocarbon emission and analysis, and stack gas composition and volumes. Pollution control methods presented and discussed are: wet and dry cyclones, carbon monoxide waste heat boilers, and electrical precipitators. The economy of a CO boiler depends on the catalyst regenerator flue gas volume, temperature, fuel value, and CO_2/CO ratio. An analysis of flue gases from CO waste heat boilers is presented for cases where ammonia has and has not been injected into the gas stream before the electrostatic precipitator. (APTIC Abs.)

24A
Dey, H. F.
AFTERBURNERS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 171-187. (PHS Publ. No. 999-AP-40).

Specifications and design parameters, the operation, applications, and efficiency of direct-fired and catalytic afterburners are discussed. Examples showing calculations of some factors considered in the design of a direct-fired afterburner to be installed in a meat smokehouse and a catalytic afterburner to be installed to eliminate odor from a direct-fired process oven are illustrated. Results of stack emissions from several direct-fired and catalytic afterburners are also outlined. The process equipment and the afterburner used in each case are briefly described. A survey of installation cost of direct-fired and catalytic afterburners reveals a general range from $5 to 10 per scfm contaminated gas. (APTIC Abs.)

25A
Dey, H., J. Maloney, and J. D'Imperio.
INERTIAL SEPARATORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 91-99. (PHS Publ. No. 999-AP-40).

Inertial separators are the most widely used devices for collecting medium- and coarse-sized particulates. They operate by the principle of imparting centrifugal force to the particle to be removed from the carrier gas stream. This force is produced by directing the gas in a circular path or effecting an abrupt change in direction. A cyclone, which is an inertial separator without moving parts, separates particulate matter from a carrier gas by transforming the velocity of an inlet stream into a double vortex confined within the cyclone. In the double vortex the entering gas spirals downward at the outside and spirals upward at the inside of the cyclone outlet. The particulates, because of their inertia, tend to move toward the outside wall, from which they are led to a receiver. Cyclones with high inlet velocities, small diameters, and long cylinders are generally found most efficient. An increase in the following will decrease the overall efficiency: (1) Carrier gas viscosity, (2) Cyclone diameter, (3) Gas outlet diameter, (4) Gas inlet duct width, (5) Inlet area, and (6) Gas density. When collection of particulates in the 5 to 10 micron range is desired, long, small-diameter, high-efficiency cyclones may sometimes be used. High-efficiency cyclones are made more effective than simple cyclones by increasing the body length and decreasing the diameter. A multiple-cyclone separator consists of a number of small-diameter cyclones operating in parallel, having a common gas inlet and outlet. Properly designed units can be constructed that have a collection efficiency as high as 90% for particulates in the 5 to 10 micron range. Centrifugal force is supplied by a rotating vane in the mechanical, centrifugal separators. Mechanical centrifugal separators are compact and are particularly useful where a large number of individual collectors are required. A method for predicting the efficiency of cyclone collectors is illustrated. (APTIC Abs.)

26A
D'Imperio, J.
OIL AND SOLVENT RE-REFINING. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson, Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 799-801. (PHS Publ. No. 999-AP-40).

Used lubricants, hydraulic fluids, and solvents are purified to produce usable products by re-refining techniques. Because the profit margin is small there is very little effort or money spent on pollution control in re-refining plants. Odors and hydrocarbon vapors are frequently released without control. A simple control technique is to enclose all emission sources and incinerate the exhaust gases in boiler fireboxes. (APTIC Abs.)

27A
Donnelly, W. H.
FEED AND GRAIN MILLS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 352-362. (PHS Publ. No. 999-AP-40).

The handling and manufacture of feed and grain products generates many varieties and concentrations of dust. These dusts are the sole air contaminants from these plants. Receiving, handling, storage operations, and feed-manufacturing processes are described as are the necessary hooding, ventilation requirements, and air pollution control equipment. More efficient control equipment is required in urban areas where nuisance complaints and air pollution regulations take effect than in farm or nonsensitive areas. (APTIC Abs. modified)

28A
Goldberg, R. and E. Higgins.
WOODWORKING EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 372-375. (PHS Publ. No. 999-AP-40).

Woodworking machines produce large quantities of waste sawdust, chips, and shavings that must be removed from the equipment site. For this purpose, exhaust systems are constructed that also alleviate conditions tending to impair health of operating personnel, collect waste that may have a resale value, and reduce fire hazards. The use of an exhaust system, however, requires a dust collector of some type to prevent air pollution problems. A typical woodworking exhaust consists of hoods for the pickup of wood dust and chips at the machines, duct-work, a collection device, a storage bin, and a fan blower to supply air for conveying purposes. Recommended exhaust volumes for average size woodworking machines are listed. The simple cyclone separator is the most common device used for collecting wood dust and chips from woodworking exhaust systems. Baghouses are sometimes used with woodworking exhaust systems. Their use is relegated to those systems handling fine dusts such as wood floor or where small amounts of dust losses cannot be tolerated in the surrounding areas. Wood dust and chips collected must be disposed of since they present a storage problem and a fire hazard. Wood waste can be used productively for such things as: Plastic bulking agent; pressed woods; soil additives; smokehouse fuel; floor sweep; wood fillers; floor cover; and waste heat boilers. When no productive disposal method can be used, wood dust and chips collected can be destroyed smokelessly by burning in a multiple-chamber incinerator. (APTIC Abs.)

29A

Hammond, W. F. and J. T. Nance.
IRON CASTING. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 258-270. (PHS Publ. No. 999-AP-40).

Control of the air pollution that results from the melting and casting of iron is considered according to the type of furnaces employed, namely, the cupolas, electric and reverberatory furnaces. The air pollutants are similar. The primary differences among the control systems are in the variation in hooding and the necessary preparation and treatment of the contaminated gases from the furnaces. Essentially the air pollution problem becomes one of entraining the smoke, dust and fumes at the furnaces and transporting these contaminants to suitable collectors. The hood and ventilation requirements, control equipment, and the air pollution problems associated with cupolas and electric furnaces are discussed. Test results of a small reverberatory furnace charging clean metal indicate a low rate of particulate discharge. No air pollution control devices have been necessary for the operations conducted in this type of furnace melting iron. An example problem illustrates typical calculations involved in designing a cupola control system. Tables giving the following data are included: general recommendations for operating commercial cupolas; dust and fume emissions from gray iron cupolas; micromerograph particle size analysis of two samples taken from a baghouse serving a gray iron cupola furnace; qualitative spectrographic analysis of two samples taken from a baghouse serving a gray iron cupola furnace; and some collection efficiencies of experimental small scale control devices tested on gray iron cupolas. (APTIC Abs.)

30A

Hammond, W. F., J. T. Nance, and K. D. Luedtke.
STEEL-MANUFACTURING PROCESSES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 241-257. (PHS Publ. No. 999-AP-40).

The two common steel-refining processes are: the basic process wherein oxidation takes place in combination with a strong base such as lime; and the acid process, wherein oxidation takes place without the base addition. Steel-refining processes are usually accomplished in the open hearth furnace, the electric furnace, or the Bessemer converter. The air contaminants vented from steel-melting furnaces include gases, smoke, fumes, and dust. The gaseous emissions result from the combustion of fuels and other combustible contaminants in the furnace charge and from the refining process. Smoke emissions result from incomplete combustion of the combustibles in the furnace charge or of furnace fuel. Particulates originate partially from dirt and impurities in the charge, but the major quantity results from the refining process. Typical particulates discharged from an open hearth and electric-arc furnace are listed. These fume emissions are largely in the form of metallic oxides, where 65-70% fall into the 0-5 micron size range. The methods of making open-hearth, electric-arc, and electric induction steel are reviewed. The air pollution problems, the hooding and ventilation requirements, and air pollution control equipment of each are discussed. Particular emphasis is devoted to design consideration of the hood and ventilation systems. Open hearth furnaces have been successfully controlled by electrical precipitators. Test results of a control system wherein a waste heat boiler and electrical precipitator vent an open hearth furnace are shown. Baghouse dust collectors, electrical precipitators, and water scrubbers can be utilized to control electric arc furnace emissions. Some of the design features of baghouses serving electric arc furnaces are outlined and test results of air pollution control systems with baghouses serving electric arc steel-melting furnaces are shown. Operating data for two installations of electrical precipitators serving electric arc furnaces are also shown. Test results on water scrubbers serving electric arc furnaces show that wet collectors collect only the larger particles and allow the submicron particles to be discharged to the atmosphere. Air pollution control equipment for the electric induction furnace is the same as outlined for the electric arc furnace. (APTIC Abs.)

31A
Hammond, W. F., J. T. Nance, and E. F. Spencer.
SECONDARY BRASS- AND BRONZE-MELTING PROCESSES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 270-284. (PHS Publ. No. 999-AP-40).

The control of air pollution in brass- and bronze-melting processes is discussed in terms of the type furnace utilized. The reverberatory, electric, crucible, and cupola type furnaces are used. A comparison of emissions from various type furnaces is outlined. The air contaminants emitted from brass furnaces consist of products of combustion from the fuel, and particulate matter in the form of dust and metallic fumes. In copper-base alloy foundries, as much as 98% of the particulate matter contained in furnace stack gases may be zinc oxide and lead oxide, depending upon the composition of the alloy. The particle sizes of zinc oxide fumes vary from 0.03 to 0.3 microns. Lead oxide fumes are within this same range of particle size. Regardless of the efficiency of the control device, air pollution control is not complete unless all the fumes generated by the furnace are captured. Hooding and ventilation requirements of the various types of furnaces are discussed separately since different problems are encountered with each. An example problem illustrates calculations involved in designing a side-draft hood for a rotary-tilting-type furnace. Baghouses with tubular filters are used successfully to control the emissions from brass furnaces. The results of tests performed on baghouses venting brass furnaces are outlined. Electric precipitators have not proved entirely satisfactory on lead and zinc fumes. A number of dynamic and static scrubbers have been tested on grass furnaces and all have been found unsatisfactory. The results of several scrubber tests are summarized. (APTIC Abs.)

32A
Hammond, W. F. and H. Simon.
SECONDARY ALUMINUM-MELTING PROCESSES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 284-292. (PHS Publ. No. 999-AP-40).

The secondary aluminum melting process is described in detail indicating the type of furnaces used, charging practices, pouring practices, and fluxing. Frequently a large part of the material charged is low-grade scrap and chips. Paint, dirt, oil, grease, and other contaminants from this scrap cause large quantities of smoke and fumes to be discharged. Even if the scrap is clean, large surface to volume ratios require the use of more fluxes which can cause serious air pollution problems. The emissions from aluminum fluxing may consist of hydrogen fluoride, hydrogen chloride, chlorine in the gaseous state, aluminum chloride, magnesium chloride, aluminum fluoride, magnesium fluoride, aluminum oxide, magnesium oxide, zinc chloride, zinc oxide, calcium fluoride, calcium chloride and sodium chloride in the solid state. Because of the widely divergent properties of these air contaminants the problem of control is complicated. A canopy hood is usually used for capturing the emissions from the charging well of aluminum reverberatory furnaces. Calculation of the quantity of air required can be accomplished as shown in an example. Some type of scrubber is required to remove the soluble gaseous fraction of the effluent, and either a baghouse or an electrical precipitator is needed to control the solids. In order to maintain adequate collection efficiency, the use of high efficiency scrubbers with a caustic solution as the scrubbing medium has been found necessary. Typical test data on collection efficiency for both ordinary and high-efficiency scrubbers are outlined. Average collection efficiencies obtained on various devices on emissions from chlorinating aluminum are outlined. The devices are horizontal multipass wet cyclone, single-pass wet dynamic collector, packed-column water scrubber with limestone packing, ultrasonic agglomerator followed by a multitude dry cyclone, and an electrical precipitator. The trend in control equipment for aluminum-fluxing emissions appears to be away from electrical precipitators and toward the scrubber-baghouse combination. (APTIC Abs.)

33A

Harding, C. I. and S. F. Galeano.

USING WEAK BLACK LIQUOR FOR SULFUR DIOXIDE REMOVAL AND RECOVERY. Tappi, v. 51: 48A-51A, Oct. 1968.

Pulp mill air pollution problems are of three basic types: odor, particulate emissions, and sulfur dioxide emissions from power boilers. Black liquor oxidation is the single step most effective for odor reduction. Work has been completed on a pilot scale on the development of a weak black liquor oxidation system using southern kraft liquor with subsequent use of the liquor for SO_2 scrubbing of power plant flue gases. The results of this work show that weak black liquor from southern kraft mills can be oxidized effectively by using kerosene for foam control. The scrubbing of the flue gas with the weak liquor by using a moderate head loss venturi scrubber (approximately 14 in. H_2O) showed consistent SO_2 removal efficiencies above 92%. Work by earlier investigators was confirmed, showing that approximately 80% sulfide oxidation gave the most effective SO_2 absorption without any measurable release of hydrogen sulfide. Complete oxidation of sulfide enhanced the formation of sulfates which inhibited SO_2 removal during scrubbing. The liquor can be recirculated for multiple passes through the scrubber provided the pH is kept sufficiently high to prevent lignin precipitation. The economics of the system indicate that a net savings of about 30¢/ton air-dried pulp can be effected by installing the integrated oxidation and scrubbing system without any dollar credit for reduction in SO_2 emissions. (Authors' Abs.)

34A
Kinsey, R. H.
VALVES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 669-672. (PHS Publ. No. 999-AP-40).

The petroleum industry employs numerous valves in its operations. Many of these valves leak causing emission of hydrocarbon vapors averaging 12 percent of the total process emission. Data on valve leakages in Los Angeles County refineries is presented (1958). The proposed emission control method for flow control valves is frequent inspection and maintenance. Rupture discs can be used to eliminate pressure relief and safety valve leaks. (APTIC Abs.)

35A
LeDuc, M. F.
ADSORPTION EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 192-201. (PHS Publ. No. 999-AP-40).

The mechanisms of the adsorption process and adsorption equipment are described with particular emphasis on activated carbon as the adsorbent. Saturation, retentivity, adsorption of mixed vapor, heat of adsorption, and carbon regeneration are included in the discussion. Activated carbon is most suitable for removing organic vapors. It adsorbs substantially all the organic vapor from the air at ambient temperature regardless of variations in concentration and humidity conditions. The limitation for molecules capable of removal by physical properties is that they must be higher in molecular weight then the normal constituents in air. In general, removal is practical for gases with molecular weight over 45. Probably the only solvent used with molecular weight below 45 is methanol. The design and operation of the fixed-bed adsorber, conical fixed-bed adsorber, and continuous adsorber are described and illustrated. An activated carbon adsorption bed should be protected from particulate matter that can coat the surface of the carbon. This can be accomplished by the use of efficient filters. Corrosion of the bed must also be prevented. Corrosion can be controlled by the use of stainless steel or by application of a protective coating of a baked phenolic resin. Polar and nonpolar solvents are equally adsorbed by activated carbon, but the recovery of polar compounds on stripping with steam requires an additional step of fractionation to effect a separation from the aqueous solution. Other solids possessing adsorptive properties are alumina, bauxite, bone char, decolorizing carbons, Fuller's earth, magnesia, silica gel, and strontium sulfate. Their industrial uses are listed. (APTIC Abs.)

36A
Murray, R. C.
PETROLEUM EQUIPMENT. GENERAL INTRODUCTION. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 561-565. (PHS Publ. No. 999-AP-40).

Operations of the petroleum industry are divided into production refining, and marketing. Air contaminants from production (drilling) are light saturated hydrocarbons and H_2S. Marketing facilities are a source of hydrocarbon vapors. Methods of control for these are presented, including incineration, maintenance of pump seals and pipe connections, vapor recovery and return, use of unvented pressure vessels, and smokeless flares. Pollution sources in the refining operation include blowdown systems, storage vessels, bulk loading, catalyst regenerators, effluent-waste disposal, pumps, and compressors, air-blowing operations, cooling towers, vacuum jets, and barometric condensers. Pollutants resulting from these sources, and control methods for each, are discussed. (APTIC Abs.)

37A
Murray, R. C.
STORAGE VESSELS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 606-629. (PHS Publ. No. 999-AP-40).

Various types of storage vessels for liquid and gaseous petroleum products are described and discussed in light of vapor emission problems (evaporation and breathing), pressure (advantages and tank design limitations), solar heating, and design of vessels and vapor seals. The types of vessels considered are: pressure; fixed, floating, and vapor seal roof; open top; reservoirs, pits, and ponds; and floating microsphere foam roof tanks. Specific emissions are vapors, mists, and odors. These are due to evaporation from wet vessel walls during draining operations, entrainment of material by winds, evaporation from the bulk caused by solar heating, and tank breathing due to diurnal temperature changes. Quantitative methods for determining the extent of these emissions are presented and illustrated. Emission control devices and methods included are vapor seals for floating-roof vessels, vent scrubbers, floating plastic blankets, vapor recovery systems, vapor conservation vessels, and vapor balance systems where various tank vents are connected. Graphs of installed cost for various types and sizes of vessels are presented. (APTIC Abs.)

38A
Nance, J. T. and K. D. Luedtke.
LEAD REFINING. In: Air Pollution Engineering Manual. Air Pollu-Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 300-305. (PHS Publ. No. 999-AP-40).

The control of air pollution resulting from the secondary smelting and reclaiming of lead scrap is discussed according to the type of furnace employed. The reverberatory, blast, and pot furnaces are the three types most commonly used. The discussion includes the use of these three furnaces, the air pollution problems, hooding, and ventilation requirements and control equipment. In addition to refining lead, most of the secondary refineries also produce lead oxide by the Barton process. This process is also briefly discussed. Test results of the reverberatory and blast furnaces venting to a baghouse control device are outlined. The baghouse efficiency was 99.1% for the reverberatory furnace and 98.3% for the blast furnace. (APTIC Abs.)

39A
Nance, J. T. and E. F. Spencer.
METAL SEPARATION PROCESSES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 305-309. (PHS Publ. No. 999-AP-40).

Metal separation processes for reclaiming aluminum, zinc, lead, solder, tin, and low-melting alloys from scrap material are described. Particular emphasis is devoted to aluminum-separation processes providing pertinent information on the air pollution problem, hooding and ventilation requirements, and control equipment. Dust and fume emissions from an aluminum and a zinc-sweating furnace controlled by a baghouse are outlined. An afterburner followed by a baghouse is recommended as control equipment for an aluminum sweating furnace. The hot gases must be cooled before entering a baghouse and radiant cooling or dilution with cold air is recommended in preference to evaporative cooling with water. In the hot-dross process, the rotating barrel need only be properly hooded and ducted to a baghouse. In the dry milling process the ball mill, crusher, and all transfer points must be hooded and vented to a baghouse. No afterburner or gas cooling facilities are required for the hot-dross or dry milling processes. An afterburner should be provided to incinerate the combustible matter discharged from a low-temperature sweating furnace and a baghouse should be used to capture the dust and fumes. In certain special applications where the only emissions are oily or other combustible material, an afterburner can be used with a baghouse. Conversely, only a baghouse is required when the process scrap is always free of oils or other combustible waste. Water scrubbers have not proved satisfactory in the collection of metallic fumes of this type. (APTIC Abs.)

40A
Polglase, W. L.
BOILERS USED AS AFTERBURNERS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 187-192. (PHS Publ. No. 999-AP-40).

Fireboxes of boilers and fired heaters can be used under proper conditions, as afterburners to incinerate combustible contaminants. To use a boiler as an afterburner demands that the following conditions exist: (1) The air contaminant must be wholly combustible; (2) The volume of contaminant gases must not be excessive; (3) The oxygen content of the contaminant gases when used as combustion air must be similar to that of air; and (4) An adequate flame must be maintained continuously. The manner of venting contaminated gases, adaptable types of equipment, burners, and safety precautions of boilers as afterburners are discussed. The advantages and disadvantages of using a boiler as an afterburner are listed. Factors that must be determined when evaluating a control system wherein a boiler is to be used as an afterburner are also outlined. An example, calculating some factors that must be considered in determining the feasibility of using a boiler to incinerate exhaust gases from meat processing smokehouses, is illustrated. Test results on several boilers used to incinerate effluents from meat smokehouses and rendering cookers are summarized showing the apparent efficiencies of boilers controlling combustion contaminants, organic acids, and aldehydes. (APTIC Abs.)

41A
Sableski, J. J. and J. E. Williamson.
FLUE-FED APARTMENT INCINERATORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 447-460. (PHS Publ. No. 999-AP-40).

There are three basic methods of altering a flue fed incinerator to prevent discharge of air contaminants. Two of these methods involve the addition of an afterburner to the existing incinerator, namely, a roof afterburner or a basement afterburner. The third method involves the installation of a well designed multiple-chamber incinerator. These three methods are discussed providing information on design procedures, standards for construction, stack emissions, and operation. Typical installations are shown schematically. The advantages and disadvantages of each method are indicated. Calculations involved in designing a barometric damper incinerator are illustrated. (APTIC Abs.)

42A
Seiler, E.
HORIZONTAL SCRUBBERS. Air Conditioning, Heating and Ventilation, v. 65: 18-20, Oct. 1968.

The design elements of a horizontal scrubber are described. Gas absorption efficiency is sacrificed with a horizontal, parallel flow scrubber. Removal effectiveness depends on solubility of the gas to be removed and impact of the gas molecules at the liquid interface. With the horizontal, parallel flow scrubber, succeeding impacts of gas molecules contact contaminated water and at the point where the cleanest air is required, the water is most contaminated. (APCA Abs.)

43A
Simon, H.
SINGLE-STAGE ELECTRICAL PRECIPITATORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 135-156. (PHS Publ. No. 999-AP-40).

The history of electrostatic precipitation, its advantages and disadvantages, diverse applications, and mechanism are discussed. The mechanisms involved in electrical precipitation are treated in detail providing pertinent information on the following: construction; voltage for successful operation (rectifiers, effects of wave form, controlled sparking rate); uniform gas distribution; theoretical analysis of performance; theoretical efficiency; effects of resistivity; and effects of nonuniform gas velocity. Proportion, capacity, cleaning of electrical system, accessibility for maintenance, control of gas flow, control of erosion of dust from electrodes, and power supply are design factors that are critical elements in an electrostatic precipitator. The fundamental theory of the mechanisms involved in electrical precipitation is only partially understood at present. Designs are based either upon previous experience with similar processes or upon the results of pilot model precipitator studies. Data is tabulated on: dielectric constants for some common materials; pioneer precipitator installations (1907-1920); summary of U. S. precipitator installations in major fields of application; typical precipitator applications (flow rate, temperature, dust concentration, dust weight, efficiency, cost); suspended particulate matter in commercial gases in typical installations; average diameter of particles in various industrial operations; typical values of drift velocity encountered in practice for use with precipitators; and typical values for some design variables used in commercial electrostatic precipitator practices. (APTIC Abs.)

44A
Spinks, J. L.
MINERAL WOOL FURNACES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 342-350. (PHS Publ. No. 999-AP-40).

The types and uses of mineral wool products, mineral wool production, air pollution problems, ventilation requirements, and air pollution control equipment are discussed. Pollutants resulting from the production of mineral wool include condensed fumes, gas such as sulfur oxides and fluorides, oil vapor, binding agent aerosols, and wool fiber. Test data indicating pollutant discharges from cupolas and furnaces, blowchambers, curing ovens, and coolers are outlined. No special hooding requirements are required in any exhaust system employed in the control of pollutants from mineral wool processes. The one possible exception is that canopy hoods may be used over asphalt tanks if emissions are excessive and are vented to control devices. The ventilation requirements for the various individual processes in a mineral wool system are outlined. Baghouses utilizing dacron or orlon bags have proved to be effective and reliable means of controlling discharges from mineral wool cupolas. Heat removing equipment must be used to prevent damage to the cloth bags. Baghouses should be equally effective in controlling emissions from reverberatory furnaces. Incineration has proved practical for controlling effluents from curing ovens. Direct-flame afterburners are preferable. If the blow chamber's temperature is maintained below 175° F to prevent the formation of oil mist, then the major problem is wool fiber. The most practical means of collecting these fibers is an efficient water scrubber. If, however, the blowchamber's temperature raises above 250° F the feasibility of using a water scrubber is diminished. The simplest and most economical method of reducing asphalt fumes is to control the temperature. If temperature control is used, best results can be obtained by using three separate tanks (melting, holding, and dip) with individual heating facilities. If control of asphalt temperature proves impractical, the fumes can be effectively controlled with a two-stage low-voltage electrical precipitator and sometimes with a high-efficiency water scrubber. (APTIC Abs.)

45A
Thomas, G.
CHEMICAL MILLING. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 801-806. (PHS Publ. No. 999-AP-40).

Chemical milling is a process for "machining" intricate metal objects by the controlled etching action of acids or bases. The piece to be milled is thoroughly cleaned and covered with an etchant resistant coating. Where etching is desired, the coating is cut away. Then the piece is submerged in an etching solution, such as NaOH for aluminum, or aqua regia for stainless steel parts. The etching reaction produces gas bubbles which break the liquid surface and entrain corrosive mists. Some etchants, such as HCl or HNO_3, have high vapor pressures and emit acid vapors. To control these emissions high capacity hoods and scrubbers are used. The operation and design of such control systems are discussed. (APTIC Abs.)

46A
Thomas, G.
COKE OVENS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 309-315. (PHS Publ. No. 999-AP-40).

Various types of core ovens are described. These include the shelf, drawer, portable-rack, car, and conveyor ovens. Heating core ovens, core binders, air contaminants from core ovens, and control methods are discussed. In foundries, core ovens are used to bake the core used in sand molds. Most cores contain binders that require baking to develop the strength needed to resist erosion and deformation by metal during the filling of the mold. Core ovens supply the heat and, where necessary, the oxygen necessary for the baking.

Generally, emissions from core ovens are a minor source of air pollution when compared with other metallurgical processes. The air contaminants discharged from core ovens consist of organic acids, aldehydes, hydrocarbon vapors, and smoke. Most core ovens are vented directly to the atmosphere through a stack. Occasionally more than one vent is used, but if emissions are such that air pollution control is needed, then ducting the vents to a control device is all that is necessary. The use of hoods or of excess air is not necessary to capture the emissions. When operated below 400° F and when fired with natural gas, most core ovens do not require air pollution control equipment. Excessive emissions from core ovens have been reduced to tolerate amounts by modifying the composition of the core binders and lowering the baking temperature. When it is not feasible or possible to reduce excessive emissions by modifying the core mix or the baking temperature, afterburners are the only control devices that have proved effective. (APTIC Abs.)

47A
Verssen, J. A.
PAINT-BAKING OVENS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 704-716. (PHS Publ. No. 999-AP-40).

Ovens, directly or indirectly fired, are used to dry, harden, and remove solvents from such surface coatings as paint, varnish, lacquer, resin, ink, enamel, and shellac. The general design of such ovens and specific standards of the fire underwriters are discussed in light of the lower explosive limit of solvent vapors. Smoke emission from the heaters can be controlled by proper choice of burners and fuel. Vapors from the drying process, such as aliphatic and aromatic hydrocarbons, ketones, alcohols and glycols, ethers, and esters can be controlled by incineration in a direct-flame afterburner. Catalytic afterburners have been found to be unsatisfactory. Tables of organic solvents, efficiencies of catalytic and flame afterburners in control of emissions, and costs of various sizes of flame afterburners are presented. Quantitative design procedures for a baking oven are demonstrated. (APTIC Abs.)

48A
Vincent, E. J.
CEMENT-HANDLING EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 339-340. (PHS Publ. No. 999-AP-40).

The equipment involved in the operation of a bulk cement plant which receives, stores, transships or bags cement includes hoppers, bins, screw conveyors, elevators, and pneumatic conveying equipment. Its main purpose is usually to transfer cement from one type of carrier to another, such as from railway cars to trucks or ships. In the handling of cement, a dust problem can occur if proper equipment or hooding is not used. Hooding and ventilation requirements of receiving hoppers, storage and receiving bins, elevators and screw conveyors, and hopper trucks and car loading are discussed. A baghouse has been found to be the most satisfactory dust collector for handling the ventilation points. All sources are normally ducted to a single baghouse. (APTIC Abs.)

49A
Vincent, E. J.
FOUNDRY SAND-HANDLING EQUIPMENT. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 315-320. (PHS Publ. No. 999-AP-40).

A foundry sand-handling system consists of a device for separating the casting from the mold and equipment for reconditioning the sand. The separating device is usually a mechanical vibrated grate called a shakeout. The minimum equipment required for reconditioning the sand is a screen for removing oversize particles, and a mixer-muller where clay and water are combined with the sand to render it ready for remolding. In addition, equipment may be used to perform the following functions: sand cooling, oversize crushing, fines removal, adherent coating removal, and conveying. A typical sand-handling system is illustrated. The air contaminants that may be emitted are dust from sand breakdown, and smoke and organic vapors from the decomposition of the core binders by the hot metal. Recommended types of hoods for shakeout grates are illustrated and the exhaust volume requirements for the different types of hood are outlined. Recommended ventilation volumes and hooding procedure for bucket elevators, belt conveyors, and mixer-mullers are presented. The most important contaminant to be collected is dust, though smoke is sometimes intense enough to constitute a problem. Organic vapors and gases are usually not emitted in sufficient quantities to be bothersome. The collectors usually used are baghouses and scrubbers. A baghouse, however, is preferred when maximum control measures are desired. (APTIC Abs.)

50A
Vincent, E. J.
PERLITE-EXPANDING FURNACES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles.

Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 350-352. (PHS Publ. No. 999-AP-40).

A plant for the expansion of perlite consists of ore-unloading and storage facilities, a furnace-feeding device, expanding furnace, provisions for gas and product cooling, product-classifying and product collecting equipment and dust collection equipment. A schematic diagram of a typical plant is shown. A fine dust is emitted from the outlet of the last product collector. The fineness of the dust varies from one plant to another, depending upon the products desired. In any event, a baghouse is needed to achieve complete control. Simple cyclones and water scrubbers have been found inadequate for collecting fine dust from perlite furnaces. Even the relatively high-efficiency devices, such as multiple small cyclones have been deficient. No hooding is required unless ventilation of the sacking machines receiving products from the cyclone is necessary. For most plants this is not required and only the air outlet of the last product cyclone needs to be ducted to a dust collector. The volume of ventilation air required depends upon the quantity of air needed to convey the product, the amount of fuel burned, and the volume of dilution air required to cool the effluent for admission to a dust collector. (APTIC Abs.)

51A
Vincent, E. J.
ROCK AND GRAVEL AGGREGATE PLANTS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 340-342. (PHS Publ. No. 999-AP-40).

Rock and gravel aggregate plants supply sand and variously sized aggregates for the construction and paving industries. The processing of the gravel consists of screening out the usable size and crushing the oversize into various size ranges. A simplified flow diagram for a typical plant is shown. An inventory of sources of dust emissions in rock and gravel plants usually begins with the first crusher and continues with the conveyor transfer points to and including the succeeding crushers. Here the rock is more finely ground, and dust emissions become greater. As the process continues, dust emissions are again prevalent from sources at conveyor transfer points and at the final screens. The points that require hooding and ventilation are the crusher discharge points, all elevator and belt conveyor transfer points, and all screens. All these dust sources should be enclosed as nearly completely as possible and a minimum indraft velocity of 200 fpm should be maintained through all open areas. One method of suppressing the dust emissions consists of using water to keep the material moist at all stages of processing; the other, of using a local exhaust system and a dust collector at all sources. The preferred dust collector device is a baghouse. A combination of a dry centrifugal collector and a wet scrubber is sometimes used. A centrifugal collector alone would allow a considerable amount of very fine dust to be emitted to the atmosphere. A scrubber of good design is required, therefore, to prevent such emissions. (APTIC Abs.)

52A

Vincent, E. J.

WET COLLECTION DEVICES. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 99-196. (PHS Publ. No. 999-AP-40).

Wet collection devices use a variety of methods to wet the contaminant particles in order to remove them from the gas stream. There is also a wide range in their cost, their collection efficiency, and the amount of power they expend. Wet collectors have the following advantages: They have a constant pressure drop (at constant volume), they present no secondary dust problem in disposing of the collection dust, and they can handle high-temperature or moisture-laden gases. They can also handle corrosive gases or aerosols, but corrosion-resistant construction may add materially to their cost. Space requirements are reasonably small. Disposal of the waste water or its clarification for reuse may, however, be difficult or expensive. Most collectors decline rapidly in efficiency for particles between 1 and 10 microns. The principal mechanisms by which liquids may be used to remove aerosols from gas streams are as follows: (1) Wetting of the particles by contact with a liquid droplet, (2) Impingement of wetted or unwetted particles on collection surfaces followed by their removal from the surfaces by a flush with a liquid. The particles can be wetted by the following mechanisms: (1) Impingement by spray droplets, (2) Diffusion, (3) Condensation, and (4) Humidification and electrostatic precipitation. Spray, cyclone, orifice, mechanical, mechanical-centrifugal collection with water spray, high pressure sprays, venturi packed tower, and wet filter type scrubbers are described and illustrated. For collection of dusts and fumes, the baghouse is to be preferred over a scrubber. If however, mists or hygroscopic particles are present in the effluent, a baghouse cannot be used. In many cases, a scrubber is the only choice. Mists that form free-running liquids when collected can be successfully collected in an electrical precipitator. If, however, sticky or gummy materials are formed, an electrical precipitator is then impractical. (APTIC Abs.)

53A
Vincent, E. J. and J. L. McGinnity.
CONCRETE-BATCHING PLANTS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 334-339. (PHS Publ. No. 999-AP-40).

Concrete-batching plants store, convey, measure, and discharge the ingredients for making concrete to mixing or transportation equipment. One type is used to charge sand, aggregate, cement, and water to transit-mix trucks which mix the batch en route to the site where the concrete is to be poured; this operation is known as wet batching. Another type is used to charge the sand, aggregate, and cement to flat bed trucks, which transport the batch to paving machines where water is added and mixing takes place; this operation is known as dry batching. A third type employs the use of a central mixplant, from which wet concrete is delivered to the pouring site in open dump trucks. Dust control equipment and hooding and ventilation requirements for each plant are discussed. Filters may be used to control dust emissions in wet concrete batching plants. No hooding and ventilation requirements are necessary. Dry batching plants present more difficult control problems. A local exhaust system with an efficient dust collector is required to control a dry batching plant adequately. This is a difficult operation to hood without interfering with the truck's movement or the batch operator's view. A canopy type hood just large enough to cover one compartment at a time provides effective dust pickup and affords adequate visibility. A baghouse is the most suitable type of dust collector for this service. A hydraulically operated, swing-away cone-shaped hood is normally used with a 2 inch clearance between the hood and mixer in central mix batching plants. A baghouse is required to collect the dust emissions. From an air pollution standpoint, the central mix batching plant is preferable to dry batching. The dust is more easily captured and there is no generation of dust at the pouring site. The operation is also preferable to wet batching because designing control equipment for a stationary mixer is easier than it is for a transit-mix truck-loading area. (APTIC Abs.)

54A
Vincent, E. J. and J. L. McGinnity.
DRIER. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 367-372 (PHS Publ. No. 999-AP-40).

Some general characteristics of driers and some details of the rotary, flash, and spray driers are considered. Air Pollution problems, hooding and ventilation requirements, and control equipment are included. Air contaminants that may be emitted from driers are dust, vapors, smoke and odor. Dust can be a problem in any drier in which the material is agitated or stirred during the drying process. Drier types that can be prolific dust producers are direct-fired rotary driers, flash driers, and spray driers. Types that produce less dust are indirect-fired rotary driers, pan driers, and cylinder driers. Other types that may emit no dust include tray driers, sheeting driers, and driers of products such as lumber, bricks, ceramic ware, and so forth. When an organic liquid is to be removed from a material, the emissions may include vapor, mist, odor, and smoke. In general, three types of control are used on driers: dust collectors, condensers, and afterburners. All types of dust collectors are used, depending upon the amount and particle size of the dust emitted. The types of dust collectors most commonly used on driers are cyclones, scrubbers, and baghouses. Condensers are used when a material wet with an organic solvent is dried. Vacuum driers are well suited to recovery of solvent vapors. Afterburners are used to control smoke, combustible particulate matter, vapors, and odors. (APTIC Abs.)

55A
Walsh, R. T.
BOILERS, HEATERS, AND STEAM GENERATORS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 525-528. (PHS Publ. No. 999-AP-40).

Boilers, heaters, and steam plants which burn fossil fuels (oil or gas) produce large quantities of particulates oxides of sulfur and nitrogen, and acid mist due to hydrolysis of SO_3. Particulate emission during normal operation and tube cleaning is discussed. The formation, reactions, kinetics, and equilibria for NO_x and SO_x are presented which form the basis for recommendation on firebox temperatures, combustion oxygen concentrations, and burner design for optimum performance. Pollution control equipment, such as cyclones, filters, electrical precipitators, alkaline additives, metal oxide and carbon filled adsorbers, afterburners, and various scrubbers are described and evaluated. Experimental data is given for several methods of control. Lowering excess air, catalytic decomposition of NO_x, reducing flame-temperatures, and eliminating air preheat are also discussed. Consideration is given to the economics of emission control, especially SO_x and to thermal efficiency. (APTIC Abs.)

56A
Walters, D. F.
WASTE-GAS DISPOSAL SYSTEMS. In: Air Pollution Engineering Manual. Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson. Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 565-606. (PHS Publ. No. 999-AP-40).

Petroleum refineries must dispose of large quantities of hydrocarbon vent, waste, blowdown, and emergency pressure release gases. Types, design, instrumentation, and operating practices for gas disposal flares are presented. These include elevated and ground level flares, burner design, steam injection, ignition and pilot light systems, flare sizes and capacities, removal of entrained mists, and provision for emergency overloads. Pressure relief systems are also thoroughly discussed. Commonly used terms dealing with relief systems are defined. Design methods and operating procedures for safety valves (standard and balanced), rupture discs, vent lines, vent headers, and vent gas scrubbers are discussed and illustrated. (APTIC Abs.)

BIOSCIENCES AND MEDICINE

57A
Battigelli, M. C.
SULFUR DIOXIDE AND ACUTE EFFECTS OF AIR POLLUTION. Jour. Occupational Med., v. 10: 500-511, Sept. 1968.

It is indicated that the search for reasonable evidence documenting a toxicological relevance of SO_2 levels, as these are encountered in urban air pollution, has thus far failed. It appears that the measurable effect of urban pollution on the health and disease of exposed populations does not involve sulfur dioxide in its mechanism.

58A
Cassell, E. J., D. W. Wolter, J. D. Mountain and others.
ENVIRONMENTAL EPIDEMIOLOGY. II. RECONSIDERATIONS OF MORTALITY AS A USEFUL INDEX OF THE RELATIONSHIP OF ENVIRONMENTAL FACTORS TO HEALTH. Amer. Jour. Public Health, v. 58: 1653-1657, Sept. 1968.

The complexity in using mortality statistics to show the effect of an environmental factor on health is discussed by pointing out different graphic perspectives of mortality data.

59A

Cralley, L. V., L. J. Cralley, and G. D. Clayton.
INDUSTRIAL HYGIENE HIGHLIGHTS. VOL. I. Pittsburgh, Pa., Industrial Hygiene Foundation, 1968, 381p.

Contents: Introduction. T. Hatch. Epidemiologic studies of occupational diseases. L. J. Cralley. Closed ecological systems. C. P. Bergtholdt. Analytical chemistry and instrumentation. R. G. Keenan. Engineering. B. D. Bloomfield. Ionizing radiation. H. F. Schulte. The non-ionizing radiations. I. Matelsky. Noise. T. B. Bonney. Work in hot environments. H. S. Belding. Ergonomics in the practice of industrial hygiene. B. A. Hertig. Toxicology. E. A. Pfitzer. Air Pollution. G. D. Clayton. Meteorology and Industrial hygiene. R. C. Wanta. Personal protective devices. W. A. Burgess. New and recurring health hazards of industrial processes. J. A. Houghton. (APCA Abs.)

60A

Friedlander, S. K. and A. L. Ravimohan.
A THEORETICAL MODEL FOR THE EFFECT OF AN ACUTE AIR POLLUTION EPISODE ON A HUMAN POPULATION and AN APPLICATION OF THE MODEL TO THE 1952 LONDON "KILLER" FOG. Environ. Sci. and Technol., v. 2: 1101-1108, Dec. 1968.

A quantitative theory for the increase in the mortality rate accompanying a severe air pollution episode has been developed, based on the following concepts: An individual dies when the activity on the gene-controlled, biochemical reaction steps in his respiratory system reaches a certain critically low value. The activity decays normally as a result of genetic changes in the somatic cells (the aging process); in the presence of severe air pollution, additional decay is produced by cytotoxic agents. The chemical effects depend on the time history of pollutant concentration in the tissue, determined by the rate at which material is transferred from the environment into the respiratory tissue. A mathematical model based on these concepts was used to correlate the data for mortality rates and concentrations collected during the London "killer" fog of 1952. Three constants with well defined physical meanings appear in the theory. The model may be applicable to the setting of environmental standards and to the development of a strategy for coping with an acute air pollution episode in an urban area. (Authors' Abs.)

61A

Goldstein, B. D., B. Pearson, C. Lodi and others.
THE EFFECT OF OZONE ON MOUSE BLOOD IN VIVO. Arch. Environ. Health, v. 16: 648-650, 1968.

Markedly reduced levels of acetylcholinesterase were found in the erythrocytes of mice exposed in vivo to 8 ppm ozone for 4 hr. A lesser reduction in glutathione levels was not statistically significant. This tends to support the hypothesis that the red cell membrane may be more sensitive to the effects of ozone than the intracellular constituents and would also support the possible role of lipid peroxidation in the mechanism of ozone toxicity. (Authors' Abr)

62A
Tabershaw, I. R., F. Ottoboni, and W. C. Cooper.
OXIDANTS: AIR QUALITY CRITERIA BASED ON HEALTH EFFECTS. Jour. Occupational Med., v. 10: 464-480, Sept. 1968.

The effects on health of smog and its major ingredients (nitrogen dioxide, ozone, and organic compounds) are examined with a view toward developing criteria for establishing air quality standards.

63A
Taylor, O. C.
EFFECTS OF OXIDANT AIR POLLUTANTS. Jour. Occupational Med., v. 10: 485-492, Sept. 1968.

Some of the topics discussed are: (1) Factors affecting response to pollutant; (2) Environmental factors; (3) Evaluation of economic impact; (4) Concentration-time relationship; and (5) Biochemical and physiological effects.

PLANTS

64A
Daines, R. H.
SULFUR DIOXIDE AND PLANT RESPONSE. Jour. Occupational Med., v. 10: 516-524, Sept. 1968.

Symptoms, environmental factors, physiological response, sulfuric acid mist, and synergism are discussed. The following statements on allowable concentrations are given. (1) Acceptable concentrations should be based on plant response; (2) Concentrations that produce visible injury symptoms on the plants concerned are too high and should be prevented; and (3) If this approach is not satisfactory and actual concentrations must be taken into account, the levels found to be safe by Thomas et al. and Katz should form the basis of judgement.

65A
Hill, A. C. and N. Littlefield.
OZONE. EFFECT ON APPARENT PHOTOSYNTHESIS, RATE OF TRANSPIRATION, AND STOMATAL CLOSURE IN PLANTS. Environ. Sci. and Technol., v. 3: 52-56, Jan. 1969.

Little is known regarding the cause of plant growth suppression resulting from photochemical pollution. Studies with ozone indicate that elevated ozone concentrations may be involved. Ozone induced partial stomatal closure and a reduction in apparent photosynthesis and transpiration. High concentrations of ozone caused a temporary reduction in apparent photosynthesis of many species, often with little or no injury developing. The effect was reversible and plants frequently recovered within a few hours. Ozone concentrations as low as 10 p.p.h.m. for several hours caused partial stomatal closure of oats. A comparison of the effects of ozone under sunlight and artificial lighting showed that photosynthesis was reduced most in sunlight. (Authors' Abs.)

66A
Landau, E.
ECONOMIC ASPECTS OF AIR POLLUTION AS IT RELATES TO AGRICULTURE. Washington, D. C., Public Health Service, National Center for Air Pollution Control. n.d., 14p.

The following findings are discussed: (1) Estimates of benefits and costs are absolutely essential to the development of effective control measures for air pollution; (2) The known effects of phytotoxicants on crops and livestock is vague and not defined, existing only for specific areas of the United States and for specific crops; (3) Only recently has interest developed over chronic or growth effects (previously concern was for acute effects with visible damage); (4) A substantial underestimate may exist in the national estimate of crop damage due to the limitations imposed from the focus on observed damage; (5) A long delay is inevitable if national estimates of crop damage are needed for legislative and political considerations; (6) An adaptation of the statewide air pollution crop survey of the University of California at Riverside might be adequate to overcome the unsuitability of existing surveys of the U. S. Department of Agriculture; and (7) An attempt to measure the marginal benefits to agriculture from control equipment (and the marginal costs) may be possible for a limited number of areas.

67A
Smith, M. E.
THE INFLUENCE OF ATMOSPHERIC DISPERSION ON THE EXPOSURE OF PLANTS TO AIRBORNE POLLUTANTS. Phytopathology, v. 58: 1085-1088, Aug. 1968.

It is seldom safe to expect the results of simple, steady-condition laboratory experiments to be transferrable to field experience; in fact, it is dangerous to extrapolate experience from one locality to another. Enough is known of the typical time histories of pollutant concentrations and related variables, however, to design meaningful experiments. The ideal technique is to determine from field measurements the actual concentration variations to which the plant is exposed, but even if this information is not available, a good approximation can be made where emission rates and meteorological conditions are known in detail. Closer cooperation among various disciplines should, therefore, lead to a much better understanding of the complex interactions involving plants and pollutants. (Author's Abs.)

AIR QUALITY

68A

ATMOSPHERIC EMISSIONS FROM THERMAL-PROCESS PHOSPHORIC ACID MANUFACTURE. Durham, N. C., Public Health Service, National Air Pollution Control Administration, Oct. 1968, 68p. (NAPCA Publ. No. 48).

This report defines the importance of the thermal-process phosphoric acid industry in the United States. Basic characteristics of the industry are discussed, including growth rate in recent years and the location of the producing sites. Process information includes discussion of normal process variables that affect the quantity of emissions, and methods of controlling or reducing emissions. Supplemental material provides detailed emission sampling and analytical methods. The data also include results from several stack-sampling programs conducted during 1966 and 1967 by United States Public Health Service.

69A

Davis, F. K. and H. Newstein.

THE METEOROLOGY AND VERTICAL DISTRIBUTION OF POLLUTANTS IN AIR POLLUTION EPISODES IN PHILADELPHIA. Atmos. Environ., v. 2: 559-574, Nov. 1968.

An analysis is presented of the general weather patterns, the vertical temperature structure and the wind conditions associated with two periods of high air pollution concentrations in Philadelphia. Measurements of the vertical distribution of pollutants and their variations are presented for the second period. (Authors' Abs.)

70A
Fensterstock, J. C. and R. K. Fankhausen.
THANKSGIVING 1966 AIR POLLUTION EPISODE IN THE EASTERN UNITED STATES. Durham, N. C., Public Health Service, National Air Pollution Control Administration, July 1968, 45p. (NAPCA Publ. No. AP-45).

This report documents the Thanksgiving 1966 Air Pollution Episode in the Eastern United States in terms of daily meteorology and ambient air quality for the weeks immediately before, during, and after the episode. The first section describes the development, progress, and breakup of the stagnating high that caused the episode. The sources and possible health effects of the air contaminants are discussed in the section on air quality. Daily levels of the various pollutants are presented graphically and the daily meteorology is correlated with the pollutant concentrations. Meteorological factors that act to disperse, or not to disperse, the various pollutants that contaminate the atmosphere are included in the appendix.

71A
Lonneman, W. A., T. A. Bellar, and A. P. Altshuller.
AROMATIC HYDROCARBONS IN THE ATMOSPHERE OF THE LOS ANGELES BASIN. Environ. Sci. and Technol., v. 2: 1017-1020, Nov. 1968.

Gas chromatographic analyses for aromatic hydrocarbons were made in Los Angeles during the fall of 1966. A concentration technique permits analysis for hydrocarbons ranging from benzene to 10-carbon aromatics. These measurements make it possible to relate the levels of aromatic hydrocarbons to atmospheric photochemical reactivity. Concentrations of aromatics averaged 0. 106 p. p. m. during this period; the maximum concentration was 0. 33 p. p. m. Toluene, the most abundant aromatic hydrocarbon, constituted 35 to 40% of the total concentration of aromatics. The more reactive dialkyl- and trialkylbenzenes constituted 40% of the aromatics measured. Ratios of many of the aromatic hydrocarbons to each other varied considerably within the same day as well as on different days. Analysis of the ratios suggested a significant contribution from solvent losses. Ratios of hydrocarbon to nitrogen oxides were consistent with the observed oxidant concentrations. (Authors' Abs.)

72A
Pilat, M. J.
AIR RESOURCES ENGINEERING. PART I. Northwest Professional Engineer, Winter 1967-1968.

Air pollution has been documented as an uncontrolled problem in many of the United States Metropolitan areas and is becoming an increasingly serious problem in smaller communities. The systematic approach to air resources engineering therefore becomes increasingly significant. To demonstrate the type of information that should be developed for use in determining air quality standards, a brief analysis of available concentration vs. effect relationships for SO_2 and airborne particulates is presented. (APCA Abs.)

73A
Pilat, M. J.
AIR RESOURCES ENGINEERING. PART II. Northwest Professional Engineer, p. 14-16, Spring 1968.

This article, second in a series, is concerned with the control of pollutant emissions at their source. Prevention of pollutant formation can be accomplished in many cases by proper control of combustion, selection of fuels low in pollution materials, or use of closed systems. Where prevention of pollutant formation is not practical, a number of pollutant removal processes are available. Several of these are described briefly. (APCA Abs.)

74A
Pilat, M. J.
APPLICATION OF GAS-AEROSOL ADSORPTION DATA TO THE SELECTION OF QUALITY STANDARDS. Jour. Air Poll. Control Assoc., v. 18: 751-753, Nov. 1968.

A quantitative approach is presented for selecting air quality standards which take into account pollutant gas-aerosol synergistic effects. These synergistic health effects have been postulated to be due to the adsorption or absorption of the pollutant gas by the aerosol particles. The approach presented in this paper assumes that the synergistic toxic agent is the adsorbed pollutant gas. Therefore, limiting the concentration of the adsorbed pollutant gas is related to the concentrations of the gaseous phase pollutant gas and the atmospheric aerosol using the Langmuir adsoption isotherm. An example is presented of the selection of air quality standards for sulfur dioxide and the atmospheric aerosol using concentration data for these two pollutants along with health effect data. (Author's Abs.)

75A
REPORT FOR CONSULTATION ON THE METROPOLITAN BOSTON INTRASTATE AIR QUALITY CONTROL REGION. Washington, D. C., Public Health Service, National Air Pollution Control Administration, Dec. 1968, 70p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, on the Metropolitan Boston urban area are presented. In accordance with the Air Quality Act of 1967 the

Metropolitan Boston Intrastate Air Quality Control Region boundaries are proposed, however, they remain subject to revision suggested by consultation with state and local authorities. Engineering (emission and diffusion) and urban factors are evaluated and supplementary illustrations are included.

76A
REPORT FOR CONSULTATION ON THE METROPOLITAN CINCINNATI INTERSTATE AIR QUALITY CONTROL REGION. Washington, D. C., Public Health Service, National Air Pollution Control Administration, Jan. 1969, 54p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, on the metropolitan Cincinnati area are presented. In accordance with the Air Quality Act of 1967 the Metropolitan Cincinnati Interstate Air Quality Control Region boundaries are proposed. Engineering and urban factors are evaluated and supplementary illustrations are included.

77A
REPORT FOR CONSULTATION ON THE METROPOLITAN LOS ANGELES AIR QUALITY CONTROL REGION. Washington, D. C., Public Health Service, National Air Pollution Control Administration, Nov. 1968, 79p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, on the Metropolitan Los Angeles urban are presented. In accordance with the Air Quality Act of 1967, the Metropolitan Los Angeles Basin Air Quality Control Region boundaries are proposed. Engineering and urban factors are evaluated and supplementary illustrations are included. The proposals stated are subject to revisions as suggested by consultation with state and local authorities.

78A
REPORT FOR CONSULTATION ON THE METROPOLITAN ST. LOUIS INTERSTATE AIR QUALITY CONTROL REGION (MISSOURI - ILLINOIS). Washington, D. C., Public Health Service, National Air Pollution Control Administration, Dec. 1968, 68p.

The results of a study conducted by the National Air Pollution Control Administration, DHEW, on the Metropolitan St. Louis urban area are presented. In accordance with the Air Quality Act of 1967 the Metropolitan St. Louis Interstate Air Quality Control Region boundaries are proposed, however, they remain subject to revision suggested by consultation with state and local authorities. Engineering and urban factors are considered in detail and supplementary illustrations are included.

79A
Sheehy, J. P., W. C. Achinger, and R. A. Simon.
HANDBOOK OF AIR POLLUTION. Durham, N. C., Public Health Service, National Center for Air Pollution Control, [1968] 1v. (PHS Publ. No. 999-AP-44).

This handbook was designed to consolidate the applicable portions of a wide variety of reference books into a single, easily accessible source. This book provides general information concerning the characteristics and behavior of air; gases and particles; the chemistry of atmospheric pollutants; and mathematical and common conversion factors. Experimental medical data are also included.

LEGAL AND ADMINISTRATIVE ASPECTS

80A
AIR QUALITY CONTROLS - INTERVIEW WITH JOHN T. MIDDLETON. Mining Congress Jour., v. 54: [8]p., Oct. 1968.

Questions and answers clarifying the Air Quality Act of 1967 are presented. The discussion emphasizes that: (1) top priority is directed to common pollutants, (2) states are responsible for standards, and (3) hostile environments are not healthy. Other topics discussed are: region designation, private sector assistance, national advisory committees, and private industry studies. The remaining discussion deals with the approach to the air pollution problem, what facets will be enlarged upon and where the emphasis will be.

81A
Krenz, W. B., J. E. Dickinson, and R. L. Chass.
AN APPRAISAL OF RULE 66 OF THE LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT. Jour. Air Poll. Control Assoc., v. 18: 743-747, Nov. 1968.

Emissions of organic solvents to the atmosphere of Los Angeles County are currently estimated at 600 tons/day. In order to reduce these emissions, Rule 66 was enacted on July 28, 1966, after more than a year of joint effort by industry and the APCD. This paper explains the provisions of the rule, describes how its enforcement will affect industry and the entire community, and discusses the methods being utilized by industry to bring its various operations into compliance. The unique approach, or philosophy, upon which this rule is based is compared with that of representative types among the many which comprise the Rules and Regulations of the Air Pollution Control District. (Authors' Abs.)

82A
Middleton, J. T.
LEGISLATING CLEAN AIR. Chem. Eng., v. 75: 20, Oct. 14, 1968.

The Air Quality Act of 1967 is summarized. The Act offers both the private and public sectors of society the opportunity to contribute to the solution of the air pollution problem. Geographical air quality control regions (interstate and intrastate) are to be established and air quality criteria on the effects of the air pollutants (and technical control information) are to be published. The states are given 90 days to set standards after HEW has designated the region and published the criterion and technology control information. If and when the state fails to meet the law's requirements the Federal government has the standby authority to move in to assure action.

83A
Ozolins, G. and R. Smith.
A RAPID SURVEY TECHNIQUE FOR ESTIMATING COMMUNITY AIR POLLUTION EMISSIONS. Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center. 1967, p. 1-77. (PHS Publ. No. 999-AP-29).

A method is presented for estimating rapidly the major emissions of air pollutants in a community. The method is based on information that is readily available in most urban areas; it does not entail extensive surveys or sampling procedures. Application of this survey method will yield a series of tables, maps, and diagrams that indicate the weights of emissions of selected pollutants, by year and by season; the relative importance of various fuels and types of sources in producing the emissions; the relative amounts of pollutants emitted in various geographic sub-areas of the community. Such information constitutes a useful tool for developing an air conservation program. (Authors' Abs.)

84A
PROCEEDINGS: MID-ATLANTIC STATES SECTION SEMI-ANNUAL TECHNICAL CONFERENCE ON THE LEGAL ROAD TO CLEANER AIR. Wilmington, Del., Hotel DuPont, Apr. 26, 1968, 93p.

Contents: Milestones in federal air pollution legislation. I. L. Auerbach. Delaware's new air pollution regulations. J. T. Wilburn. Legal aspects of air pollution control from the state level. R. J. Sullivan. 1968 Essay contest participants. Student Award Papers: A study of the relationship between emission rates for selected air pollutants and population. W. S. Baker. The removal of particulates from the atmosphere by rain. P. LeClare. Minutes of the business meeting of the MASS-APCA. Guest speaker. Honorable J. C. Boggs.

A status report on interstate air pollution compacts. H. M. Englund. A citizen lawyer looks at clean air. K. Kowald. The development of administrative regulations pursuant to statutory authority. D. B. Sebree.

85A
RULES AND REGULATIONS OF THE AIR POLLUTION CONTROL DISTRICT. LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT. In: Air Pollution Engineering Manual, Air Pollution Control District: County of Los Angeles. Ed. by J. A. Danielson, Cincinnati, Ohio, Public Health Service, National Center for Air Pollution Control, 1967, p. 831-857. (PHS Publ. No. 999-AP-40).

The rules and regulations of the Los Angeles air pollution control district are presented. Included are: definitions; permits—where required, application, and exemptions; fees—for permits, emission analysis, and technical reports; prohibitions—maximum emissions, smoke shade, open fires, petroleum storage, incinerators, fuel composition, solvents, exemptions; hearing board procedures—filing petitions, appeals, hearing notice and location, and evidence; orchard or citrus grove heaters—permits, exceptions, and prohibitions; emergencies—plans, alerts, action, enforcement, and committees. (APTIC Abs.)

SOCIAL ASPECTS

86A
Heller, A. N.
THE ROLE OF THE SCIENTIST IN URBAN ECOLOGY. Trans. New York Acad. Sci., v. 30: 1027-1044, June 1968.

Scientists play a central role in the management of air problems in New York City. An emission inventory procedure has been established for evaluation of the emissions into New York City's air from hundreds of thousands of sources. The principal objective of this inventory is to given an estimate of the spatial and temporal distribution of emissions. The monitoring network is based on a technical evaluation of the complex meteorological problems. Pollutant systems must be viewed from the point of view of multi-components, since the synergistic interaction of pollutants has a profound effect on the problem. The air resource management encompasses economic, sociological, technological, and physiological factors. Only through effective use of computer techniques can the interplay of these diverse problems be handled in a reasonable time. (APCA Abs.)

87A
Leduc, E. C.
THE SOCIO-POLITICAL CHARACTERISTICS OF URBAN GOVERNMENTS ENGAGED IN AIR POLLUTION CONTROL ACTIVITIES. Jour. Air Poll. Control Assoc., v. 18: 733-737, Nov. 1968.

Ten variables representing metropolitan location, wealth, pollution potential, and administrative capability were collected on 446 cities over 10,000 population in the United States. These cities were separated into three groups: (1) old program cities—cities with programs in existence before 1965 (N = 213); (2) no program cities (N = 223); and (3) new cities—cities that have air pollution control programs supported by federal program grant (N = 10). As expected, the old program cities tend to be the large central cities with manufacturing characteristics. The no program cities are the higher income white collar, and low pollution potential suburbs and satellite cities. Both groups had essentially the same political forms of government. Different from either of the other two groups; the new program cities have air pollution potential characteristics like the old program cities and tend to have a greater proportion of high income families like the no program cities. Unlike the other two classes of cities, they have no specific metropolitan location and have higher proportions of poor and lower proportions of home owners. One conclusion drawn is that the federal grants program has the effect of encouraging areas with pollution potential, but fewer local resources, to enter control activities. These governments are smaller in population and are not as strongly associated with metropolitan areas as were program cities in the past. It is also likely that the existence of a professional bureaucracy increases the government's ability to secure program grants. (Author's Abs.)

88A
Middleton, J. T.
AIR CONSERVATION—WHOSE RESPONSIBILITY? Washington, D. C. Public Health Service, National Air Pollution Control Administration, [1968], 8p. (Presented at New England Conf. Air Pollution, Colby College, Waterville, Maine, Dec. 2, 1968).

The concept that air pollution is everyone's responsibility is defended. The ways in which state and local governments, educational and research institutions, business and industry, and the general public can help to insure that the Air Quality Act produces informed and intelligent decisions on the quality of the air we all must breathe are discussed.

89A
Middleton, J. T.
THE AIR QUALITY ACT OF 1967 - THE ROLE OF THE BUSINESSMAN. Industrial Med. and Surg., v. 37: 598-602, Aug. 1968.

Various methods are discussed in which the Air Quality Act allows all levels of government and industry to help fight air pollution in new scientific and constructive ways.

90A
Middleton, J. T.
AIR QUALITY CRITERIA - SCIENTIFIC CORNERSTONES OF THE 1967 AIR QUALITY ACT. Jour. Occupational Med., v. 10: 535-538, Sept. 1968.

It was indicated that the cornerstones for building our efforts to protect the public from the relentless ravages of air pollution now and in the future are the air quality criteria. The effectiveness of these efforts will depend in large part on the soundness and the validity of the criteria. The scientific evidence of the effects of air pollution must be used to sharpen our awareness of its true menace to the public health and welfare.

91A
Sableski, J. J.
HOW TO CONDUCT A JOINT COMMUNITY-WIDE ODOR SURVEY. Air Eng., v. 10: 16-18, Sept. 1968.

A community wide odor survey often is conducted as part of an air resource management plan to provide background information on air pollution. A guide is presented for setting objectives, selecting observers, evaluating sensitivity, and making odor measurements. Results from a Kansas City survey illustrate the method. (APCA Abs.)

BASIC SCIENCE AND TECHNOLOGY

92A
Cralley, L. J., M. M. Key, D. H. Groth and others.
FIBROUS AND MINERAL CONTENT OF COSMETIC TALCUM PRODUCTS. Amer. Indus. Hyg. Assoc. Jour., v. 29: 350-354, Apr. 1968.

Twenty-two talcum products, showed an 8-30% fiber count (19% average), predominantly talc with minor amounts of tremolite, anthophyllite, and chrysotile generally under 1 μ in diameter with lengths 1.5-6.0 μ. One sample had 54.4% quartz and 21 showed 0.3-3%

quartz. The levels of Co, Ni, Cr, and Mn were low except for 4 samples with levels with a disease potential. Cosmetic talcum products should be included among the fiber sources from which may be derived the pulmonary ferruginous bodies (previously called asbestos bodies), whose significance is uncertain. (Chem. Abs.)

93A

Levy, A. and E. L. Merryman.
SULFUR-OXIDE FORMATION IN CARBONYL SULFIDE FLAMES. Environ. Sci. and Technol., v. 3: 63-68, Jan. 1969.

Oxidation processes in low-pressure (0.1-atm.) carbonyl sulfide flames are examined. Two distinct reaction zones are noted, a zone in which carbon monoxide and sulfur dioxide are formed and a zone in which the carbon monoxide oxidation is completed. Kinetic analysis suggests that the initial step is the abstraction of a sulfur atom by an oxygen molecule, $OCS + O_2 \rightarrow [OCS\text{-}OO] \rightarrow CO + SOO$. The rate constant for this reaction is $k_5 = 8.2 \times 10^{14} \exp(-29,100/RT)$cc/mole/sec. (Authors' Abs.)

94A

STATUS REPORT 1968. AEROSOL RESEARCH IN PROGRESS. Jour. Air Poll. Control Assoc., v. 18: 651-696, Oct. 1968.

Within the past few years there has been a great proliferation of aerosol research: in the number of workers, in the available tools, and in the number of topics. To the researchers, the problem of keeping abreast of work in the over-all field of aerosol research has become difficult. Frequently, one is made of an investigation only long after it is completed—when it is reported by the normal publication approach. The Air Pollution Control Association, in 1967, acted to assist those interested in an early exchange of aerosol research information. At the 1967 APCA Annual Convention in Cleveland a special technical session was offered to present status reports on aerosol research in progress. Summaries of the talks given at this session were subsequently printed in the September 1967 issue of the APCA Journal. A similar session was given at the 1968 APCA Annual Convention in St. Paul, and the corresponding summaries are presented in this issue of the APCA Journal. (APCA Abs.)

95A

Thomas, N. T. and K. Nobe.
INTRAPARTICLE DIFFUSION IN CATALYTIC COMBUSTION OF METHANE, ETHANE, AND PROPANE. Environ. Sci. and Technol., v. 2: 622-627, Aug. 1968.

The effects of pore diffusion of methane, ethane, and propane were investigated with $CuO-Al_2O$ catalyst pellets of two different sizes to determine catalytic elimination of air pollutants from hydrocarbon-consuming combustion processes. Analysis of experimental data indicates that pore diffusion effects were negligible only for smaller pellets. Good agreement between calculated and experimental data of larger pellets was obtained by considering both surface and gas-phase pore diffusion. (Eng. Index)

96A
Whitby, K. T. and A. R. McFarland.
ELECTRICAL MEASUREMENT OF THE MASS CONCENTRATION OF A SELF-PRESERVING AEROSOL SIZE DISTRIBUTION. Jour. Air Poll. Control Assoc., v. 18: 760-764, Nov. 1968.

Recently fifty-eight measurements of urban aerosol size distributions by Clark have shown that these distributions agree quite well with the self preserving form proposed by Friedlander within the size range of 0.05 to 5 microns radius. This paper shows that for an aerosol obeying the self preserving distribution model, the volume concentration (and hence, the mass concentration for constant density) is directly proportional to the electric current collected when the aerosol is unipolarly charged, passed through a weak electric field to remove particles smaller than 0.05 micron and then collected by a current collector. It is shown that the linear relation between the mass concentration and collected current is independent of the unipolar charging method used. A test of this theory using Clark's electric counter data was encouraging and suggests that the electric measurement of urban aerosol mass concentrations by properly designed instruments may be feasible. (Authors' Abs.)

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